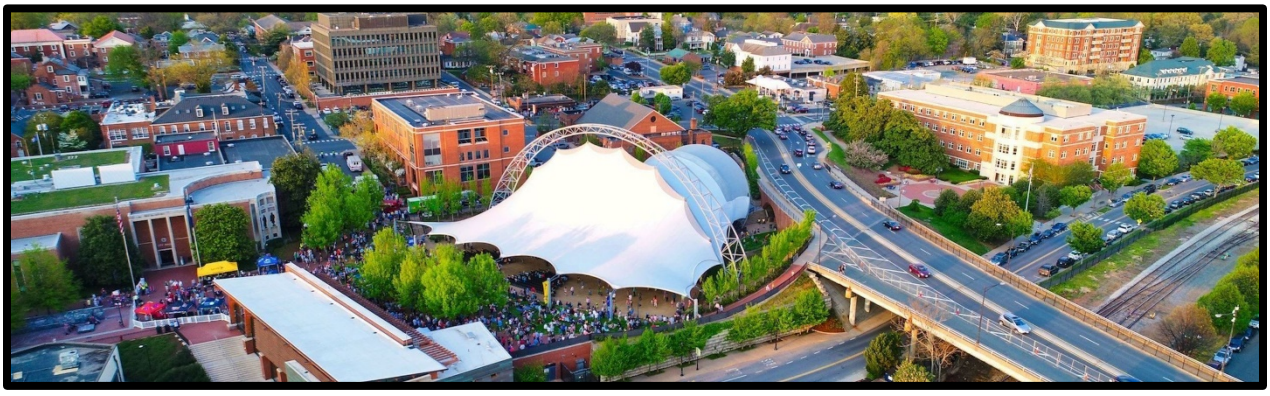
# City of Charlottesville Fiscal Year 2021 Annual Energy and Water Performance Report

*Spring 2022*



Energy & Water Management Program
City of Charlottesville

# Table of Contents

# Introduction

The City of Charlottesville's Energy and Water Management Program (EWMP) monitors and manages energy and water usage of the City's municipal sites, which include both local government and public schools. The EWMP is focused on supporting the Charlottesville community-wide climate action goals (achieving a 45% reduction in greenhouse gas emissions by 2030 and carbon neutrality by 2050) by taking necessary actions that improve efficiency, reduce the reliance on fossil fuels, and decrease greenhouse gas emissions from municipal sites. The EWMP tracks the energy and water usage at these facilities to gauge performance, coordinates with the City's Facilities Maintenance and Facilities Development teams on building operations and improvement projects, works with staff to develop strategies that expand the renewable energy footprint of buildings, and engages with staff, faculty, and students to help lessen their impact on energy and water usage (Image 1).

Building on the comprehensive performance baseline in the FY2020 Annual Energy and Water Performance Report (key links provided in Appendix 1), this report outlines actions and the energy and water performance of over 70 municipal sites in the 2021 fiscal year (July 2020 – June 2021). The City's performance was reviewed on an account, building, and building group level, where building groups are categories of similar use types of the City's municipal facilities such as schools, fire stations, and offices (See a list of all the City's facilities and building groups included in this report in Appendix 2).

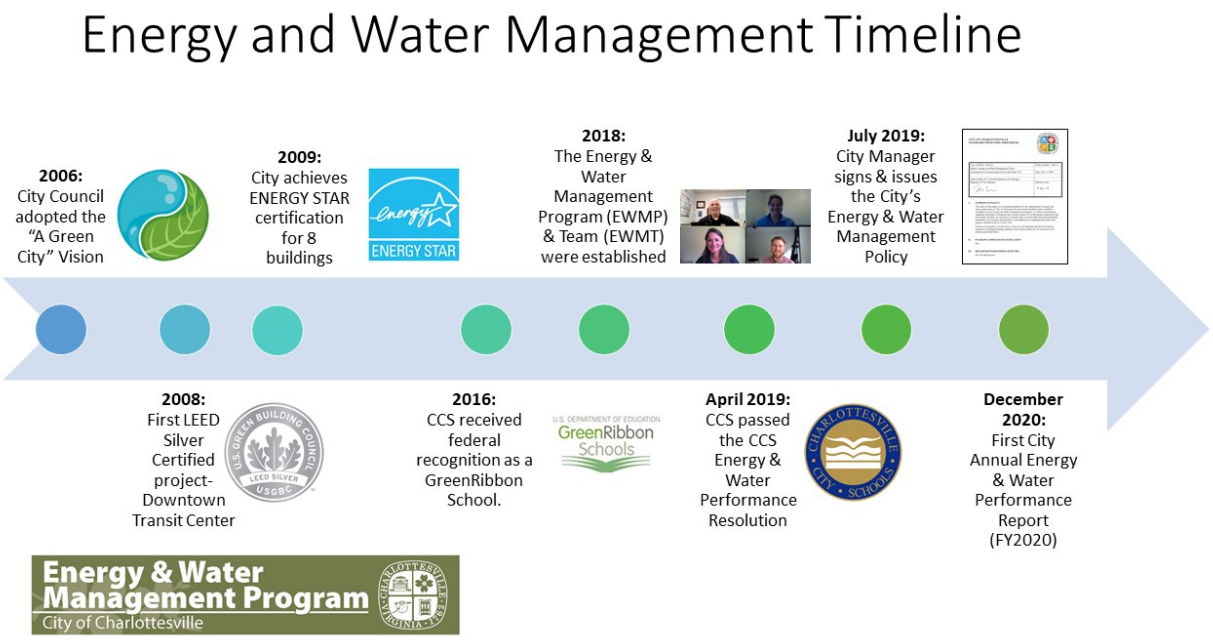



**Image 1:** Timeline of important events and initiatives around energy and water management efforts in the City of Charlottesville leading up to this report (Appendix 1, Appendix 3, Appendix 4)

## COVID-19 Influence

FY2021 will forever be "another" unique year for the City of Charlottesville due to the Coronavirus (COVID-19) and the impact COVID-19 had on building use and performance. In mid-March 2020, City facilities, including schools, were closed due to Virginia State and the Center for Disease Control

guidelines for people to shelter in place as the world faced the threat of a global pandemic. As a result, significant number of staff pivoted to work remotely, students shifted to learn remotely, and the public was served through modified or alternative means. While some City programs and services continued to operate and be delivered from regular sites, many City facilities were shut down completely - only running essential services to keep issues like humidity controlled. This new trend of reduced occupancy and utility usage continued through most of the fiscal year. The impact of these partial shutdowns on the City's performance is further explored in the *Performance* section of this report. Charlottesville City Schools did start opening some of their facilities in limited capacity to staff in the summer months of 2020 including using CCS facilities to help provide lunches to students.

COVID-19 is a large part of the story in this FY2021 report as it impacted an essential driver in energy and water use: building occupancy. COVID-19 created the new challenge of tracking improvements in performance due to strategies implemented by the EWMP to increase efficiency; however, this report makes clear that decreases in utility usage were primarily driven by the low to no occupancy of these facilities for a large portion of the year. The EWMP will continue to explore how to handle this unique year in the City's portfolio performance.

## Actions and Performance

Building off previously published data and information (Appendix 1 & Appendix 5), this report explores progress made in FY2021 in utility usage and cost data. The report incorporates the three focus areas identified to improve energy and water performance: operations, technology, and people. The implementation of strategies in all three areas were significantly impacted by COVID-19 resulting in actions that were delayed, cancelled, or modified.

## Operations

The efficient operations of facilities represent the lowest cost but potentially the highest impact opportunities for achieving energy and water reductions. As mentioned in the FY2020 Report, efficient operations can be realized by examining the control and maintenance of heating, ventilation, and air conditioning (HVAC) systems and lighting in facilities, then aligning this with the current needs of building occupants. The goal is to run equipment optimally and efficiently and eliminate unnecessary operations. As we moved into FY2021, many facilities still had low occupancy due to the response to COVID-19 and the EWMP's objective was to ensure that facilities did not operate more than necessary while still maintaining appropriate operations to maintain safety for any occupants. The Energy and Water Management Team (EWMT) continued to coordinate strategies for the EWMP to properly manage efficiency in City buildings (Image 2). In FY2021, the EWMT worked to monitor operations and performance of City facilities as demands continued to shift throughout the year. The EWMT coordinated monthly with Facilities Maintenance representatives to communicate any findings, providing another set of eyes on how facilities were "behaving" as operating schedules continued to fluctuate throughout the year. As the COVID-19 pandemic continued through FY2021, the EWMT provided monthly and more comprehensive quarterly updates on the impact of COVID-19 on utility usage and costs.


***Image 2:*** *The Energy and Water Management Team (EWMT) is currently comprised of Kirk Vizzier (Environmental Sustainability), Jill Greiner (Environmental Sustainability), Kristel Riddervold (Environmental Sustainability and Facilities Development), and Mark Zavicar (Facilities Maintenance) and are seen here coordinating via Zoom during COVID-19.*

The Facilities Maintenance Division was tasked with continuing to scale facility operations to meet changing needs and with implementing safety measures within facilities that prevented the spread of COVID-19, including HVAC equipment measures (e.g., MERV 14 filters, bi-polar ionization, UV light filtration, extended ventilation operation) and enhanced sanitation measures. The City participated in information sharing sessions with facilities maintenance staff from the University of Virginia (UVA) and Albemarle County about best practices for addressing COVID-19 concerns within management of facilities. Facilities Maintenance was on the frontlines of keeping facilities operating in a way that created a safe working environment for occupants while at the same time preventing unneeded conditioning in areas that were unoccupied. Throughout FY2021, balancing safety with efficiency was a primary goal of the EWMT.

## Strategies Implemented

### *Reviewing HVAC Schedules and Communication Processes*

The FY2020 report touched on the importance of scheduling HVAC operations appropriately and maintaining effective communication between occupants and the HVAC maintenance representatives. This has continued to remain a major factor in controlling energy and water performance at City facilities. At schools, the Fall 2020/Spring 2021 semesters provided a unique testing ground to show if this was being done effectively, as schools had shifting occupant needs throughout the year.

Although school occupancy was lower from March 2020 to June 2020 with virtually no students or staff, occupancy began to ramp up gradually in July 2020 with more consistent staff occupancy by September 2020. Although occupancy was still reduced, staff were typically spread out throughout the schools, and thus HVAC systems had to run on a more normal operating schedule starting in July 2020 to maintain comfort in all areas of schools. Students remained remote throughout most of the 2020/2021 school year.

Occupancy in many municipal (government) buildings continued to remain low throughout FY2021 with some departments coming in more often than others depending on their work responsibilities. The Facilities Maintenance team adjusted operating hours of equipment to match the needs of staff throughout the year. Additionally, the team made an effort to scale back HVAC operations in areas that did not require heating or cooling (Note: HVAC measures to maintain safety in response to COVID-19 were implemented in all appropriate areas regardless of this). School staff, City staff, and Facilities Maintenance had to maintain good lines of communication regarding the needs of each municipal and school facility at any given time.

An interesting point to note is that with reduced occupancy, there is less heat that naturally occurs in spaces from body heat and the use of electronics such as computers. City Hall, City Hall Annex, and many school facilities experienced this in the cooler months of FY2021, and heating systems had to operate longer to maintain comfort levels in occupied areas.

### *Demand-side Management – Load Shedding*

Building automation systems (BAS) are a management tool that is installed in many City and School buildings. The City has implemented programming in these systems to decrease the energy demand (load) at the facility once the BAS starts reaching a designated kilowatt (kW) threshold. This limits the amount of energy used at a facility automatically during times when the energy demand is high, such as at peak times throughout the day or throughout the year. Typically, energy “load shedding” occurs by changing the operations of equipment that use energy to lower the overall energy load at the facility. Equipment that is considered non-critical to facility operations is identified and is either shut off directly or temperature settings that control the equipment are adjusted to reduce its operation. Currently this is in place at most schools and the EWMT continues to work with Facilities Maintenance to fine tune the appropriate settings that trigger load-shedding events at these locations. The EWMT is helping to evaluate the integration of this strategy at more facilities.

## Strategies Planned/FY2022 Outlook

Looking further into FY2022, the EWMT will continue to monitor utilities and City operations to ensure that systems are only running when necessary. School operations during FY2021 stayed consistent, but

with students returning to in-person learning in FY2022, the same strategies outlined above were utilized to control the energy and water usage at school facilities throughout the year. Municipal building operations in FY2022 were generally similar to those seen in FY2021. COVID-19 HVAC measures that were put into place in FY2021 and, in many cases, had an energy penalty (caused energy usage to increase). Even once occupancy levels return to normal, as long as those measures are still in place, HVAC energy usage will have a base level increase over the normal operating years prior to 2020. This is to be expected and puts a greater emphasis on managing energy usage through monitoring and scheduling operations appropriately.

# Technology

Building equipment (e.g., HVAC, BAS/control systems, lighting, and plumbing fixtures) continues to increase in efficiency and offers greater abilities to reduce energy and water usage. In previous years, the City has annually implemented projects that cycle in more efficient systems with the end goal of improving the efficiency of facilities. The existing funding mechanisms have allowed for gradual upgrades of equipment over time that address equipment efficiency. However, to ensure that emergency funding was in place to support COVID-19 response, the City put a temporary hold on most projects slated for FY2021. This meant that only the most urgent projects were authorized to move forward for a period of time. Although some construction projects were placed on hold, technology was utilized in a myriad of ways over the year to manage energy and water usage.

The EWMT continued to utilize the EnergyCAP Utility Tracking System among other software tools including the Tableau Data Visualization tool and SAP to monitor and aid in managing energy and water usage at facilities. Several viewable EnergyCAP dashboards are available to various groups in the City and the data provided in this report can also be viewable and interacted with in an EnergyCAP dashboard outlined and accessible in Appendix 6.

## Strategies Implemented

### *Installation of LED Lighting*

With the improvements seen in LED (light-emitting diode) technology, the City has made an effort to prioritize choosing LEDs in place of conventional lighting technologies such as incandescent, halogen, fluorescent, and metal halide. The City has upgraded lighting systems including installing LEDs and lighting controls (e.g., dimmers and occupancy sensors) in municipal and school facilities by incorporating into renovation projects where feasible and as stand-alone projects.

In FY2021, the City moved forward with a number of projects that removed inefficient lighting from facilities and replaced with lighting that improved energy efficiency, lighting performance, and overall occupant satisfaction. Two major projects replacing T8 fluorescent lighting with linear LEDs were completed on the main floor of Central Library and throughout the lower level of Market Street Parking Garage that is used by the Charlottesville Police Department. Older plug-in compact fluorescent lighting located at the Juvenile and Domestic Relations Court building was replaced with more efficient LED recessed can lights. At the Charlottesville Area Transit operations center, pole-mounted metal halides in the parking lot were replaced with LEDs improving the light distribution throughout the parking areas. LED upgrades at Smith Aquatics Center included various lighting throughout the natatorium area and bollard lighting outside the facility.

Ongoing modernization and fit-out projects include upgrades to the lighting and lighting controls where feasible. Renovations of the basement of the Police Building included the addition of flat panel LEDs, linear LEDs, and advanced lighting controls including occupancy sensors, vacancy sensors, and manual switches with dimming capabilities. A major renovation in a large portion of the Circuit Court building was completed in FY2021 and included LED lighting upgrades and expanded lighting controls. Similarly, a modernization project at Burnley Moran Elementary for the Media Center and iSTEM Lab areas included the installation of LED fixtures. This project began in FY2021 and was completed at the start of FY2022. The City will continue to standardize the use of LEDs and advanced lighting controls in future projects.

### *Replacing HVAC Equipment*

HVAC equipment replacement is typically a high-cost endeavor that is budgeted as far as 5 years in advance to plan accordingly and is primarily focused on older equipment that is reaching the end of its useful life. Although COVID-19 restrictions on project spending did slow down projects, the City was able to move forward with a number of HVAC related projects in FY2021. Replacements of chillers at both Central Library and the MLK Performing Arts Center at Charlottesville High School (CHS) and an air handling unit at Central Fire Station will provide more efficient operations at each facility and offer greater ability to manage comfort levels. Additionally, one of the boilers that provides space heating at Clark Elementary was replaced with a more efficient model. The Circuit Court building renovation completed in FY2021 also included the installation of a new chiller and BAS. Although not HVAC equipment, the solar thermal domestic water system at Smith Aquatics Center was repaired and brought back online in FY2021 with expanded programming through the BAS, reducing the need for natural gas for water heating.

At the end of FY2021, Facility Maintenance began working to replace twenty-two console units at Buford Middle, Clark Elementary, Greenbrier Elementary, Venable Elementary, and Walker Upper Elementary and began the replacement of make-up air units at Walker Upper Elementary with completion scheduled for FY2022.

### *Project Rebate Programs Through the PJM Regional Transmission Organization*

The City has continued to participate in the Energy Efficiency program offered by the Pennsylvania, Jersey, Maryland (PJM) Regional Transmission Organization, the organization that manages the electric grid across portions of the Mid-Atlantic and Mid-West regions of the United States. Through this program, the City has received quarterly financial incentives for projects that improved energy efficiency of facilities including a chiller replacement at Charlottesville High School, an AHU replacement at City Hall, and rooftop heat pump replacements at Walker Upper Elementary (Table 1).

***Table 1:*** *Total annual incentives from the energy efficiency improvements in the City as part of the PJM Regional Transmission Organization Energy Efficiency program.*

| Fiscal Year | Annual Incentive |
|---|---|
| FY20 | $1,429.47 |
| FY21 | $1,304.93 |

The City has designated a fund that is earmarked for energy and water efficiency to allocate these payments, and the EWMT will continue to submit new (eligible) projects for this program to capture additional funding to be reinvested into efficiency projects.

### *Energy Savings Performance Contract (ESPC)*

The EWMT has been investigating an energy savings performance contract (ESPC): an alternative method for financing and implementing efficiency projects. An ESPC is presented as a budget-neutral approach whereby an energy savings company (ESCO) identifies and implements energy and water savings projects with a guaranteed annual utility savings that covers the cost of the projects.

In early 2020, the EWMT began working with Virginia Energy (formerly Department of Mines, Minerals and Energy) - the state agency that assists public entities in going through the ESPC process. In February 2021, the City initiated the first stage (a “Back of Envelope” audits request for proposals) to evaluate

potential ESCOs to partner with in pursuing an ESPC. Details regarding the scope of the ESPC continued to be developed in FY2022; these efforts are anticipated to enable much needed upgrades that will improve the energy and water efficiency of facilities to be implemented on a large scale and at a faster pace than through the current Capital Improvement Project (CIP) process.

### *Touchless Faucets*

As part of a COVID-19 mitigation effort, the City replaced faucets in several City facilities with touchless faucets that have sensors to turn on and turn off automatically after 30 seconds. These faucets were installed to reduce having to touch high use surfaces and reduce the spread of diseases in high traffic areas. Faucets with automatic time-outs also help save water by preventing unintended water loss when faucets are left on. 33 touchless faucets were installed throughout City facilities: Public Works Administration Building (6), Facilities Maintenance Building (1), Public Transport Building (4), Charlottesville Area Transit Buildings (9), City Hall (8) and City Hall Annex (5).

### *Bottle Filling Stations*

During the beginning of FY2021, 45 water fountains in schools were updated to newer water fountain and bottle filling stations. There are now at least two new water fountain and bottle filling station located at each City school (Elementary schools had 2 to 4 installed, Walker had 2 installed, Buford had 3 installed, and Charlottesville High School had 13 installed) (Image 3). These bottle fillers support the use of tap water for drinking water over plastic/bottled water.


***Image 3:*** *Students at Clark enjoying their new water bottle filling station.*

### *ENERGY STAR Appliances & WaterSense Fixtures*

As a requirement stated in the City's *Energy and Water Management Policy (Appendix 3)*, Environmental Protection Agency (EPA) ENERGY STAR and EPA WaterSense labeled products need to be prioritized where economically feasible. The City seeks to include appliances that meet these standards in all modernization projects where applicable. The Burnley Moran Elementary modernization project included the installation of a dishwasher and refrigerator that were ENERGY STAR certified appliances. Additionally, it included replacing all existing smartboards with LED display smartboards that are ENERGY STAR certified. The renovation in the breakroom at the Circuit Court building included a Samsung ENERGY STAR certified refrigerator. A restroom renovation at the Jefferson Madison Regional Library- Central Branch was completed in FY2021 and included the installation of two WaterSense certified urinals using 0.5 gallons per flush.

## Strategies Planned/FY2022 Outlook

Looking into FY2022, a selection of projects are scheduled to move forward. The BAS at City Hall is going to be upgraded to ensure that equipment controllers and communications devices used by the BAS are up to date and functioning properly. The upgraded BAS will have advanced programming in place to make it easier to monitor and manage operations as effectively as possible. A BAS upgrade at Venable Elementary was started at the end of FY2021 and was completed at the beginning of FY2022. A modernization project is being planned at Greenbrier Elementary and will likely include LED installations.

The back of the envelope (BOE) phase of the ESPC will be completed in FY2022 and the City anticipates beginning the investment grade audit (IGA) phase where a large portfolio of facilities will be reviewed for energy and water savings opportunities. These audits will help inform the planning of energy and water projects that will ultimately lead to reductions in energy and water usage throughout municipal and school facilities, substantially contributing to municipal greenhouse gas reductions.

Expanding the amount of energy derived from renewable sources will be a key strategy for the municipal sector portion of the City's Climate Action Plan which is currently under development. Solar has been identified in current planning discussions as the primary technology being considered, and multiple avenues for adding more capacity are being reviewed. These include power purchase agreements (PPAs) to install solar energy systems onsite at facilities and accessing offsite solar through virtual power purchase agreements (VPPAs). Onsite solar power systems reduce the need for grid-purchased electricity, but system size and generation potential are limited by roof and ground space. Offsite solar provides the opportunity to access higher capacity systems that will produce larger amounts of solar energy. The City is evaluating how best to achieve the largest greenhouse gas reductions while achieving the direct benefits of onsite solar. Currently, the City is reviewing the solar

❖ Solar

In September 2017, the City's solar PV systems surpassed 1 gigawatt hour (1,000,000 kilo-watt hours) of electricity production, and as of FY2021, have produced over 2 gigawatt hours of electricity. Solar systems are incorporated into new construction buildings, such as Fontaine Fire Station and Smith Aquatics Center (Image 4), as well as existing buildings, such as the City Yard Warehouse. The electricity produced by these systems is used directly at the site and most energy production data is tracked and monitored by the EWMT (Table 2).

***Table 2:*** *Solar photovoltaic systems installed to date at City facilities.*

| Facility | Installed Capacity (kW) | Year Installed | Location |
|---|---|---|---|
| Charlottesville High School | 111.8 | 2012/2013 | Roof and ground mount |
| City Yard Warehouse | 44.3 | 2016 | Roof |
| ecoREMOD Energy House | 5.8 | 2011 | Roof |
| Facilities Maintenance Building | 21.1 | 2012 | Roof |
| Fontaine Fire Station | 17.7 | 2016 | Roof |
| Lugo McGinness Academy | 9.4 | 2015 | Roof |
| Smith Aquatics Center | 40.5 | 2016 | Roof |

***Image 4:*** *Solar PV system on the roof of Smith Aquatics Center.*

potential of roofs and comparing to roof replacement schedules so that any onsite systems are timed appropriately with roof replacements. Solar feasibility is anticipated to be included in the ESPC investment grade audits described above.

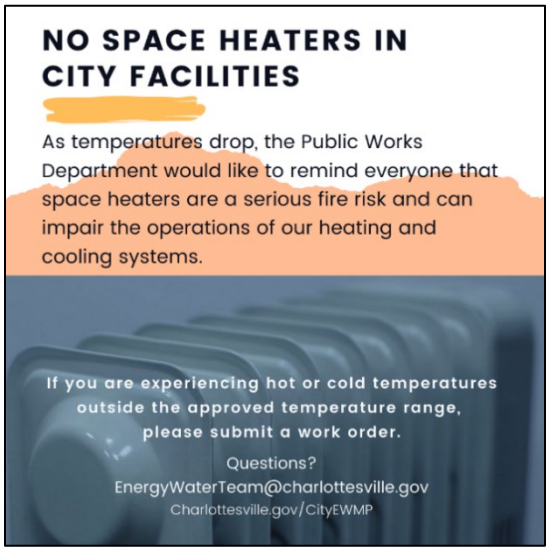
# People (Behavior)

The people that use and interact with a facility can have a significant impact on that facility's performance. The EWMP works to support users of all ages and empower them to contribute to the efficient performance of the facility. A primary strategy the EWMP utilizes to connect with staff and the people that use these facilities is through education and outreach about how the facility works. To support the large amount of information related to the policy, potential questions related to the policy, and resources to help save energy and water at the workplace, the EWMT keeps an intranet website up to date for staff with all resources and updates (Energy and Water Management Program Intranet City Website- *note this website is for internal access only*).

## Strategies Implemented

### *Employee Outreach and Engagement*

During the winter of FY2021, several messages were put out around energy conservation. Space heater use typically increases when the temperature drops outside, and in order to ensure staff knew the use of these were not allowed in City facilities, an announcement was sent out to City (using the City's Employee News Flash) and School staff (through each school's principal) (Image 5). This was also paired with information about hot and cold comfort issues and a recommendation to use the work order process to notify Facilities Maintenance staff to help identify the problem rather than try and mask it with a space heater, which ultimately causes more heating and cooling issues for the space. During the holidays, the EWMT provided a holiday reminder to turn off and unplug electronics, make sure exterior windows and doors were closed, and no water fixtures were leaking before leaving for holiday break (Image 6).





***Images 5:*** *Image used in email/Employee News Flash announcements reminding staff to not use space heaters.* ***Image 6:*** *Image used in the Employee News Flash to unplug and shut down electronics and other conservation actions before the holiday break.*

### *Better Business Challenge*

The City and CCS were part of the 2020/2021 Better Business Challenge hosted by the Community Climate Collaborative. This challenge encouraged the entire Charlottesville area to improve the

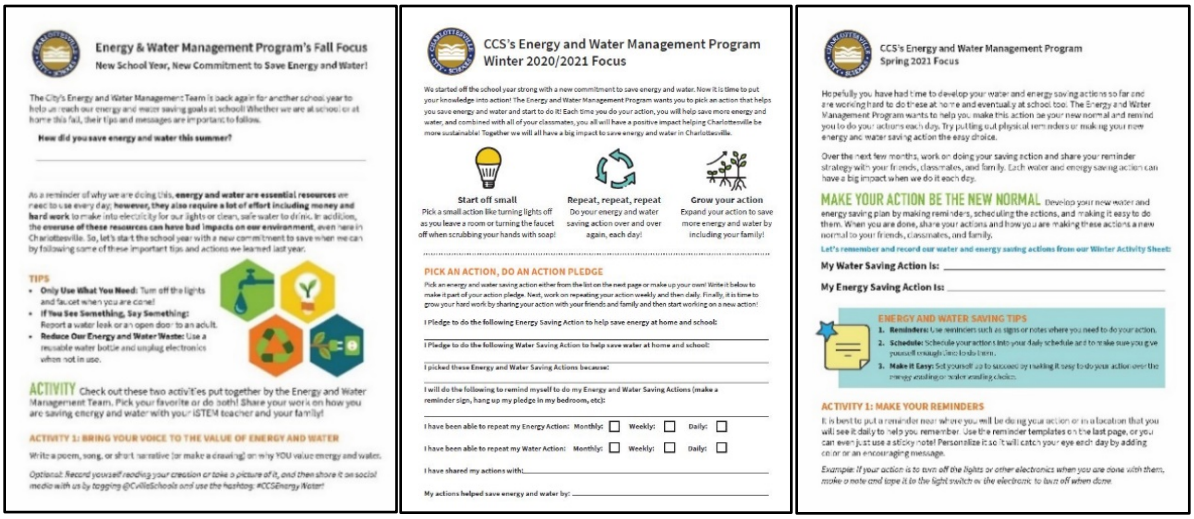
performance of their buildings through monitoring and making improvements. The EWMT helped manage the City's participation in the challenge as many of the program initiatives of the EWMP align with those of the Better Business Challenge. The City received one of the Champion Awards for their efforts in the Better Business Challenge (Image 7).

***Image 7:*** *EWMT member, Kirk Vizzier, accepting a 2020/2021 Better Business Challenge Champion Award on behalf of the City of Charlottesville.*

### *Energy and Water Management Campaign at CCS*

The EWMT continued the momentum generated from FY2020 to engage staff and students around the importance of energy and water efficiency in their buildings. Quarterly updates with each school's principals continued at which their school's performance and upcoming educational initiatives were discussed. Due to COVID-19 starting in Spring 2020, these quarterly check-ins were pivoted to email updates with the option for remote meetings if principals had follow-up questions. The EWMT continued publishing quarterly educational messages and materials to staff and students with some type of educational material, an announcement message, and reinforcing outreach through social media.

The overall message of the 2020/2021 academic year for CCS was to "Commit to Water and Energy Saving Actions". With this being the second year the EWMP-delivered outreach messages to CCS students, the program worked to build on what students learned last academic year to start bringing action to this information regardless if they are at school or at home. For the majority of FY2021, activity sheets were used to continue engagement with students while they were remote (Images 8 - 10). These were pushed out by CCS's iSTEM staff on asynchronous Friday learning days when there was more flexibility for curriculum activities. Materials were also distributed to each school's principal including announcements, activity sheet materials, and social media images to support additional outreach within their respective schools.




***Images 8 - 10:*** *EWMP quarterly themed activity sheets for 2020/2021 Academic Year (Fall, Winter, Spring respectively). Full versions can be viewed on the [EWMP website (LINK).]*

To ensure messaging and engagement reached students while they were not in school buildings, education materials and messages were also supported through other outreach means including social media, newsletters, websites, and utility billing inserts. With an increased reliance on digital and remote learning, CCS and the City both made sure messaging and materials were well featured on their respective websites and highlighted in CCS digital newsletters (CCS Energy and Water Conservation Website Link and City's EWMP Education and Outreach Website Link).

❖ Case Study: Climate Action Kits at Walker Upper Elementary School

On Earth Day, 400 5th graders at Walker Upper Elementary School in Charlottesville received Climate Action Activity Kits created by the Community Climate Collaborative and the Virginia Discovery Museum in partnership with the City of Charlottesville's Energy and Water Management Program. The kits were designed to help students gain a greater understanding of home water and energy use and climate emissions, while connecting families to local energy and water-efficiency solutions.

The kit included an energy scavenger hunt and grown-up guide with information on local rebates and energy efficiency resources; plant your own herb garden/decorate a pot; a t-shirt with art materials to create and decorate a reusable grocery bag; a solar-powered night light; and a water leak detection activity. Kits were offered in both English and Spanish.

The City's Energy and Water Management Program was excited to help bring these Climate Action Kits to Charlottesville City School students. EWMP have been working with Charlottesville City Schools on ways students can save energy and water for over a year and a half and having the opportunity to provide a hands-on activity to further support the program's message is instrumental in getting students to implement change at school and at home.

## Strategies Planned/FY2022 Outlook

### *WE@Work*

The EWMT has been working on a program focused on engaging with staff to promote positive behaviors related to saving energy and water in the office. This program is called WE@Work, standing for "Water and Energy at Work", and is a structured set of steps that help workplaces increase their efficiency and change behaviors (Image 11). The EWMT hoped to launch the program in FY2021; however, COVID-19 and the large number of employees working remotely has caused this project to be delayed until more staff have returned to City facilities. The EWMT also developed an "At Home" version of WE@Work to engage remote staff at such time that this program can be launched.

***Image 11:*** *WE@Work Logo for EWMP's workplace engagement program standing for Water and Energy at Work.*

### *Energy and Water Management Campaign at CCS*

The EWMT plans to continue education and outreach efforts at school through quarterly educational messaging and materials. With COVID-19 continuing to impact the world and school in FY2022, activity sheets will be the primary materials developed to further the EWMP messages. Depending on COVID-19 and school structure in the 2021/2022 academic year, the EWMT hopes to re-engage students around improving energy and water performance in their schools. This includes supporting more hands-on learning opportunities for students.

# Performance

The EWMP actively monitors the performance of the City's facilities looking for trends, abnormalities, and successes when it comes to energy and water performance. Performance data is often matched to actions outlined above such as changes in building operations, technology, and occupant behaviors. In addition, weather can significantly impact a building's performance; therefore, degree day data is noted in this report to take into account variations in temperature from year to year. The year 2016 is used as the City's weather normalization standard (all energy data is adjusted according to deviation from 2016 heating and cooling degree days) as it represents a typical and expected weather trend for Charlottesville, Virginia. In addition, the year 2015 was used as a performance baseline for utility tracking as it is the earliest full year of utility usage that includes all the current facilities in use by the City.

COVID-19 posed a unique challenge for monitoring City facilities as building occupancy and operations dropped drastically when lockdowns and modified usage and schedules were in place during FY2021. The impacts and changes resulting from energy and water efficiency improvements will be hard to separate from these significant changes in operations. The EWMT presents the performance metrics of City facilities below; however, reductions in usage and costs are largely the result of reduction in operations and decrease in occupancy in these facilities due to COVID-19. The EWMT continues to track the impacts of COVID-19 and to research how best to handle such a unique year in the City's portfolio performance.

The City's portfolio performance was assessed by looking at each utility account, each building, and each building group. Building groups are categories of typical use types of the City's facilities and a way to compare similar types of facilities to each other within a building group and to national standards. The EWMT has identified 11 building groups which represent the various 70+ City facilities, and Appendix 2 references which specific facility falls under each building group (Table 3). This performance section reports primarily on information and trends at the building group level with a few individual facilities highlighted.

The figures and data from this report can be viewed through an interactive dashboard on EnergyCAP. See the appendix for further instructions regarding how to access this information (Appendix 6).

***Table 3:*** *The City's 11 building groups and important portfolio performance metrics.* *Source for Regional Average EUI*

| Building Group | Gross Floor Area (sq. ft.) | Site Energy Use Intensity (kBtu/sq.ft.) | Regional Average EUI | FY2021 Energy Change (compared to FY2020) | FY2021 Water Change (compared to FY2020) |
|---|---|---|---|---|---|
| Courthouses | 59,886 | 51.9 | 101.2 | 57% | -13% |
| Fire Stations | 60,660 | 50.2 | 63.5 | 3% | -7% |
| Libraries | 46,945 | 65.3 | 71.6 | 7% | -39% |
| Offices | 243,550 | 48.3 | 52.9 | 1% | -11% |
| Parks | -- | -- | -- | -8% | -13% |
| Recreation & Sports | 121,953 | 44.2 | 50.8 | -56% | 3% |
| Schools | 845,984 | 48.5 | 48.5 | 6% | -21% |
| Street Lights & Traffic Signals | -- | -- | -- | -7.9% | -- |
| Transit & Parking* | 235,292 | 25.8 | 56.2 | 1% | -25% |
| Vehicle Charging Stations | -- | -- | -- | -13% | -- |
| Warehouses & Fleet Mixed Use | 88,908 | | -- | -7% | 9% |
| *Offices*** | *43,340* | *47.1* | *52.9* | | |
| *Vehicle Repair**** | *45,568* | *57.9* | *47.9* | | |

** Includes bus terminals and parking garages. Regional Average EUI is for bus terminals.*

***Includes Facilities Maintenance building, Pupil Transportation building, and CAT Transit Operations Center (EUI is weighted average).*

****Includes City Yard Warehouse and City Yard Wash Facility (EUI is weighted average).*

## EUI and ENERGY STAR Scores

To measure performance, we compare each building to itself overtime to see how energy and water usage has changed over the years. For energy, we also compare buildings to each other using metrics known as Energy Use Intensity (EUI) and ENERGY STAR scores. The EUI is a measure of how much energy (electricity, natural gas, etc.) a building uses per square foot - the lower the EUI, the better.

Most of the City of Charlottesville building groups on average had a lower EUI in FY2021 compared to the regional average for their representative building groups (Table 3). Although upgrades to more efficient equipment and building to green building standards have contributed to this performance, in cases where occupancy was greatly reduced due to response to COVID-19 (e.g., offices and schools), corresponding reductions in HVAC and lighting operations played a large role in reducing the EUI compared to previous years.

Another measure of performance is the ENERGY STAR score. The City has 37 facilities benchmarked using ENERGY STAR Portfolio Manager, an online tool that allows buildings to receive a score (1-100) based on the level of energy efficiency compared to similar facilities across the nation. ENERGY STAR for buildings is a measure of operational performance at that point in time. The City achieved ENERGY STAR certification in 2009 for facilities that met the prerequisite score of 75 (Appendix 7).

Ten facilities reached the prerequisite score in FY2021 but have not yet been certified. As occupancy and operations were reduced drastically in Spring 2020 due to COVID-19 and have only partially seen some re-occupancy in FY2021, the ENERGY STAR scores are likely inflated, representing an inaccurate view of energy performance for many facilities. The City is finetuning space attributes in ENERGY STAR Portfolio Manager based on ENERGY STAR guidance to reflect the shift in operations across the 37 benchmarked facilities (Appendix 7) and will then evaluate pursuing ENERGY STAR certification for eligible facilities once confident of their accuracy.

## Portfolio Performance

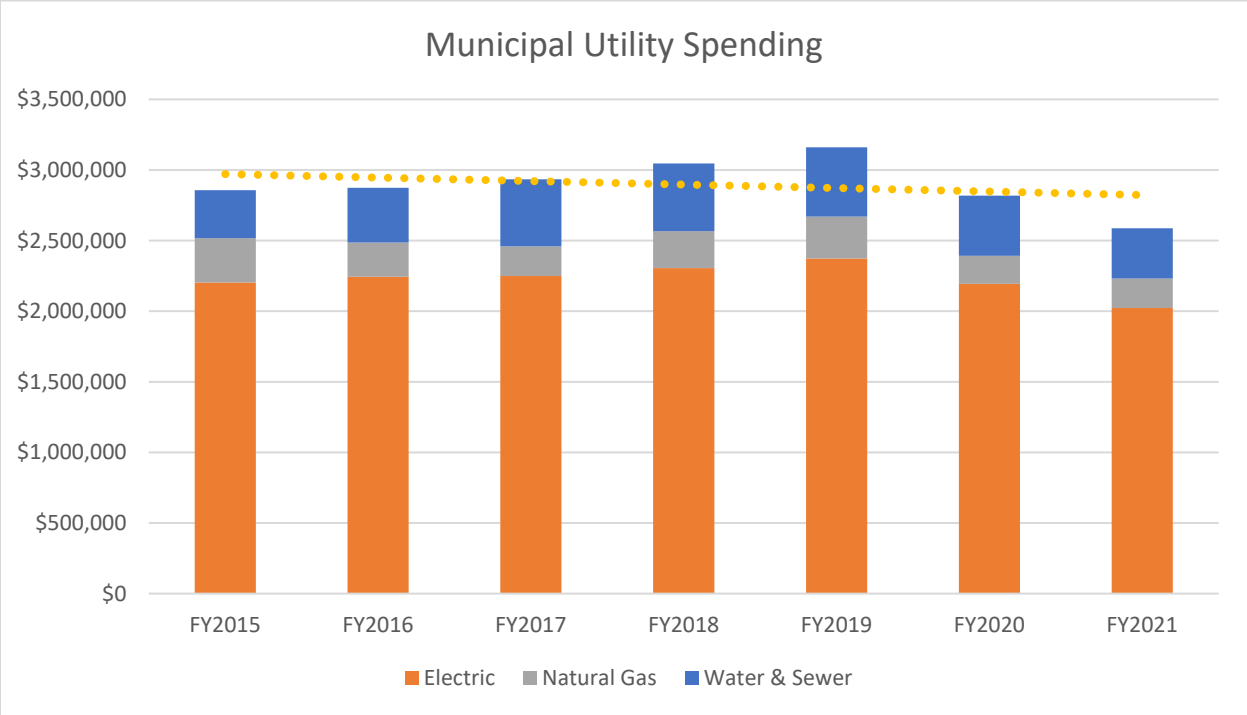



***Figure 1:*** *The City's utility spending for the past 7 fiscal years for each commodity type across all City facilities. The yellow dotted line is the overall trend in spending over time across all 7 years.*

Overall, the City (government and schools) spends over $2.61 million for energy and water utilities in FY2021, which follows a declining trend since FY2019 and lowest cost in the past 7 fiscal years (Figure 1). Even with utility rates increasing, this significant decline in cost can be associated with COVID-19 causing facilities to be shut down for FY2021 and those facilities that were open were run at reduced occupancy.

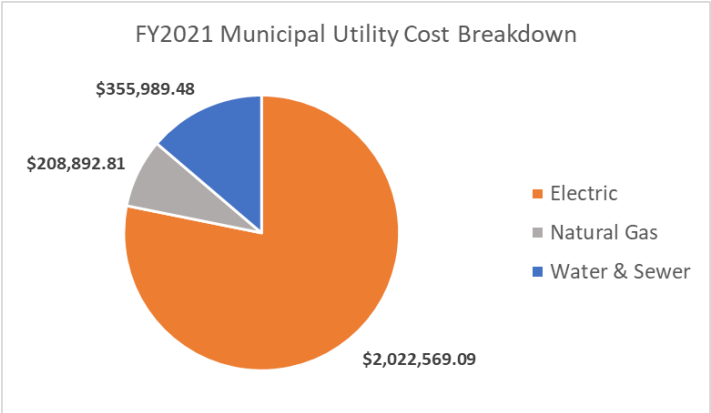



***Figure 2:*** *The City's annual utility spending broken down by commodity type for FY2021 across all City facilities.*

Electricity makes up the majority (78%) of the City's utility costs with water and sewer as the next largest at 14% of cost

and natural gas contributing 8% of utility costs (Figure 2). Compared to the portfolio baseline fiscal year 2015, FY2021 saw an 8% decline in electricity cost, a 33% decline in natural gas cost, and a 5% increase in water cost. Water's increase in cost is the result of a few large water leaks in FY2021 (Downtown Transit Station) as well as an increase in water accounts (particularly recreational water usage like splash pads) since 2015. Overall, the goal of the EWMP and City is to reduce our utility consumption and utility costs through efficient management of those utilities and improved behaviors. A general goal of a 2% reduction in utility consumption per year was applied to the baseline usage in FY2015, by which FY2021 would ideally show a 12% reduction in utility usage. The City saw significant declines in usage when compared to FY2015 (baseline year), a 15% decline in electricity, a 19% decline in natural gas, and a 25% decline in water. The test of this decline will come after COVID-19's impact to utility usage subsides as previous fiscal year trends did not hold to the 2% annual reduction. In addition, the general goal of a 2% reduction in utility usage annually is currently being re-evaluated as part of the City's climate action process to ensure reductions are aligning appropriately with the City's larger climate action goals.

## Electricity

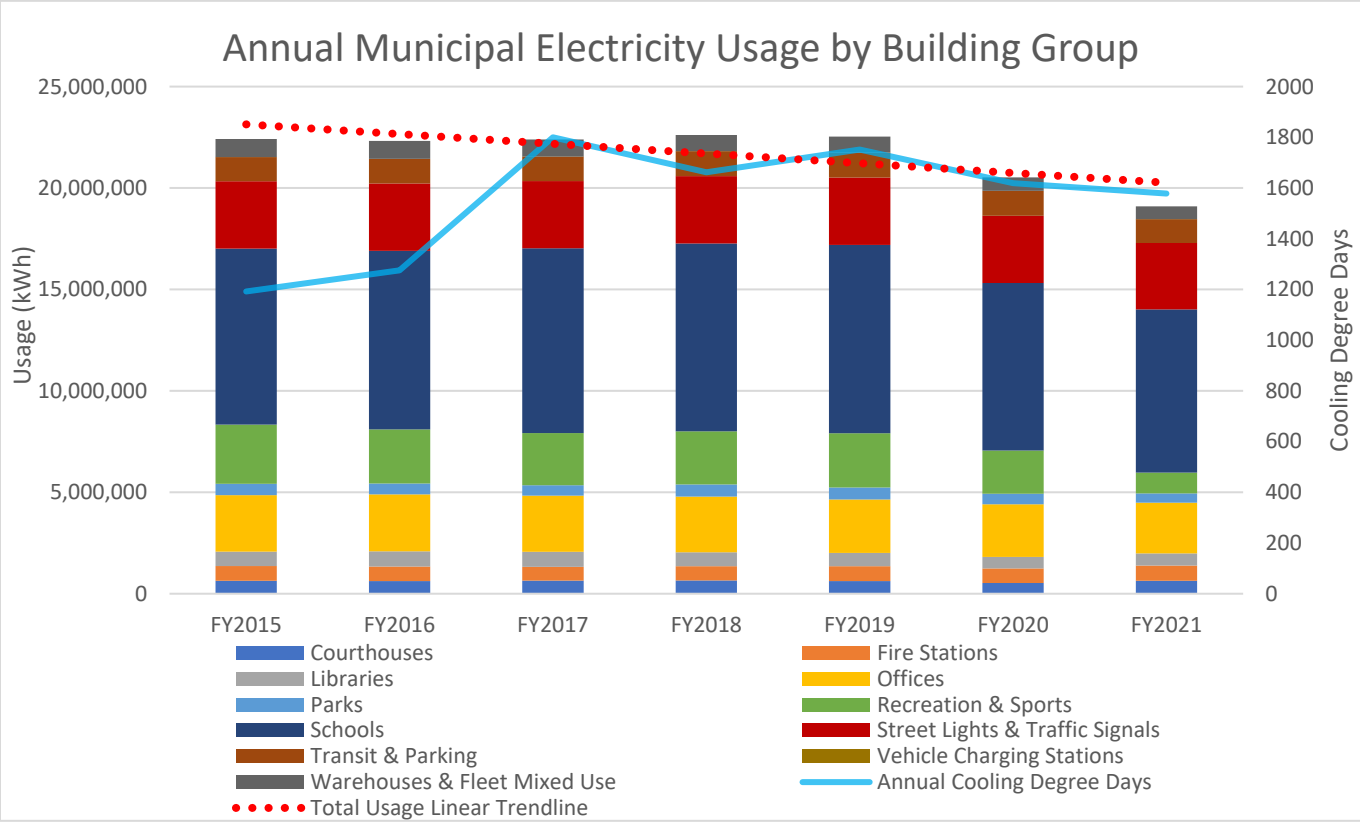



***Figure 3:*** *The City's electricity usage for the past 7 fiscal years across all City facilities and partitioned out by building group. Annual Cooling Degree Days are included to show variance in weather conditions each year.*

As stated above, electricity makes up the bulk of spending for utilities at 78% of total utility costs. Electricity use across the City's building portfolio has had some fluctuation since FY2015 (baseline year) but it has for the most part remained steady through FY2019 (Figure 3). As stated previously, adjustments to operations in response to COVID-19 in the latter part of FY2020 and maintaining for

most of FY2021 caused major reductions across all utilities making FY2021 an anomaly year. Electricity usage dropped 8% in FY2021 compared to FY2020 and 8% compared to FY2015, which cannot all be credited to improvements in building efficiency (Appendix 8.1). However, without the concerted efforts of Facilities Maintenance teams to reduce equipment operations to only operate when necessary, these reductions would have been much less during this period.

Electricity use at facilities is mainly tied to the cooling and ventilation systems, indoor/outdoor lighting, and equipment plug load. Beyond facilities, the City portfolio also includes street light, traffic signals, and vehicle charging stations.

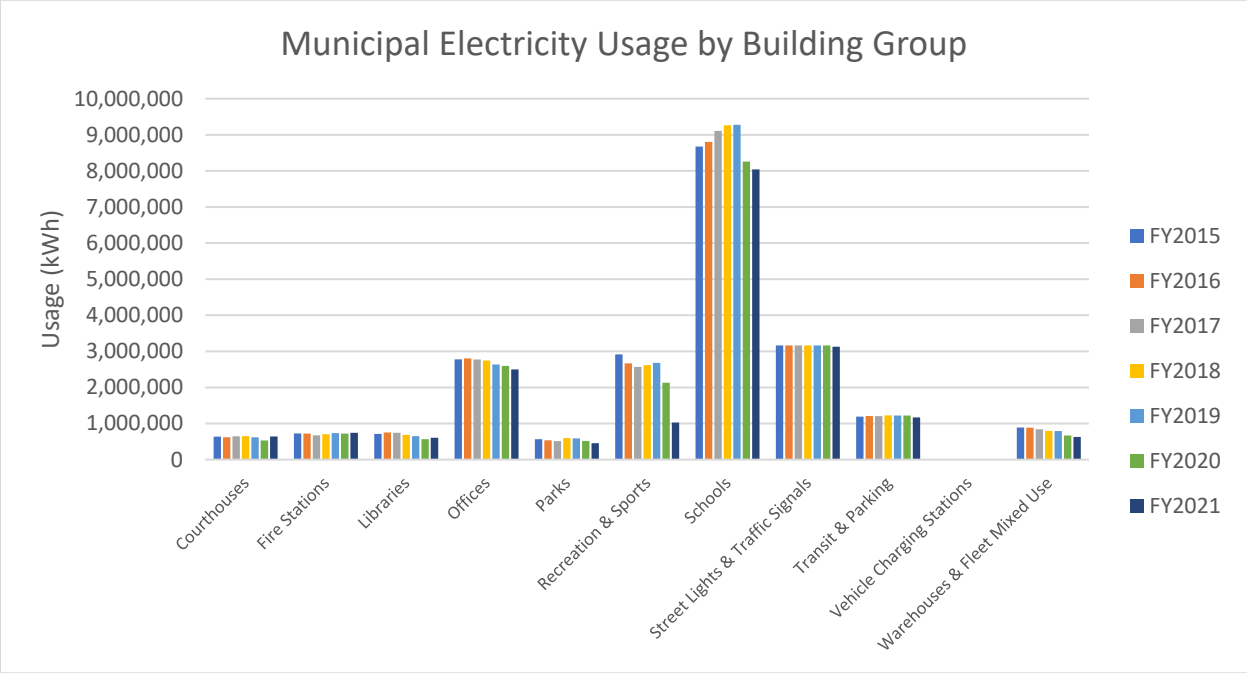



***Figure 4:*** *The City's electricity usage for each building group over the past 7 fiscal years.*

When looking at the City's portfolio by building group, most groups have trended down over the past 6 years (Figure 3 & 4). However, schools have continued to see an increase in electricity usage through FY2019 and since schools make up nearly 50% of the electricity usage of the City's portfolio, it tends to drive the overall performance of the portfolio. This electricity increase is mostly related to two factors: construction and renovation projects and expanded after-hours/summer activities. The EWMT is consulting industry best practices and successful methods for working with contractors more effectively to manage energy use during projects.

The significant drop in electricity usage seen in FY2020 and FY2021 across most building groups is related to scaling back operations of buildings in response to lower occupancy due to COVID-19. Had Facility Maintenance teams not been vigilant about adjusting operations to meet these changing needs, the electricity reductions would have been much less. It's important to note that the Courthouses building group did see a rise in FY2021 due to Circuit Court renovations being completed and returning to normal operations (within COVID-19 requirements). Additionally, Fire Stations continued to operate normally during this period and remained steady throughout FY2020 and FY2021. Smith Aquatics Center

was shut down for HVAC renovations during much of FY2021 which contributed to the major drop seen in the Recreation & Sports building group.

Beyond Schools, the Offices and Recreation & Sports building groups tend to have the most impact on the portfolio's electricity usage, so focusing efforts on improving performance at City Hall, City Hall Annex, and Smith Aquatics Center has become a more targeted priority.

The Street Lights & Traffic Signals building group has estimates included in the historical data from FY2015 – FY2019 for some street light accounts using FY2020 consumption amounts. Historical data is still being gathered for specific analysis but the EWMT is confident that the estimated amounts provide a defensible comparison. As the majority of street lights that are in the City's portfolio are owned by Dominion Energy, the EWMT is planning to work with Dominion to develop a plan for upgrading street lights to LEDs.

## Natural Gas

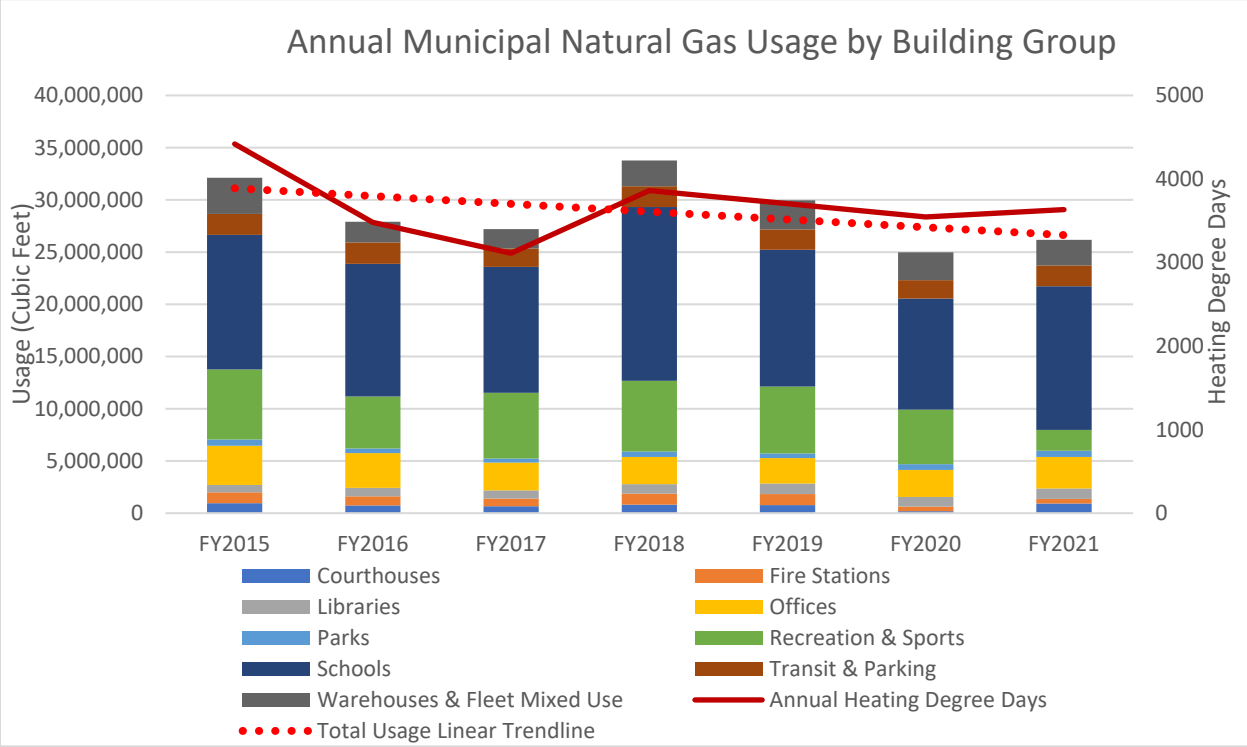



***Figure 5:*** *The City's natural gas usage for the past 7 fiscal years across all City facilities and partitioned out by building group. Annual Heating Degree Days are included to show variance in weather conditions each year.*

In FY2021, natural gas represented approximately 8% of utility spending in the City's building portfolio. Schools, Recreation & Sports, and Office building groups have the highest usage of the portfolio due to the size of the facilities and type of use. In most cases, natural gas is used for space heating and water heating, and in schools, it is also used by kitchen appliances.

As space heating is a major driver of natural gas usage, a year that is colder on average than other years will typically mean more natural gas use at facilities. Natural gas usage for the City's portfolio as a whole

has tended to follow the trends of heating degree days (days throughout the year where temperatures drop below a standard point requiring heating) (Figure 5). Schools use the most natural gas of all of the building groups and tend to sway the portfolio (Figure 6). Throughout FY2019 and into FY2020, the portfolio saw a drop in natural gas compared to previous years, in part due to improvements in efficiency around operations of heating systems. Facilities Maintenance teams across all facilities investigated areas to reduce unnecessary heating by adjusting schedules and equipment settings to trim up operations while working with all City staff to ensure that comfort is being maintained. The teams have made this a standard practice to perform during the heating season each year. Although there was a reduction in FY2020 compared to FY2019 attributed to reduced operations of facilities due to COVID-19, the portfolio saw a 5% increase in natural gas in FY2021 (Appendix 8.2). In many facilities, there was limited staff scattered throughout buildings, but the HVAC systems continued to have to run to supply conditioned air. During the winter of FY2021, buildings that previously had more heat from plug load and people were mostly empty, and therefore to continue to heat spaces to satisfy occupant comfort of limited staff, heating systems had to operate longer. This was mostly seen in office buildings and schools.

Recreation & Sports facilities saw a 62% drop in natural gas in FY2021 compared to FY2020 (Appendix 8.2) because of shutdowns at facilities in response to COVID-19 and closings for major HVAC renovations at Smith Aquatics Center. Offices saw an increase of 17% overall, driven mainly by space heating at City Hall Complex and City Hall Annex to keep space temperatures comfortable in areas with reduced occupancy. Courthouses saw a major spike in natural gas usage in FY2021 due to the reopening of the Circuit Court building after renovations, as was mentioned in the “Electricity” performance section.

In late summer 2017 (FY2018), Charlottesville High School experienced a natural gas leak during the summer which caused a major spike in natural gas usage, which can be seen in FY2018 usage and was the main driver for the increase seen at the City portfolio level that year (Figure 6). The issue was addressed but not before a considerable amount of natural gas loss had occurred.

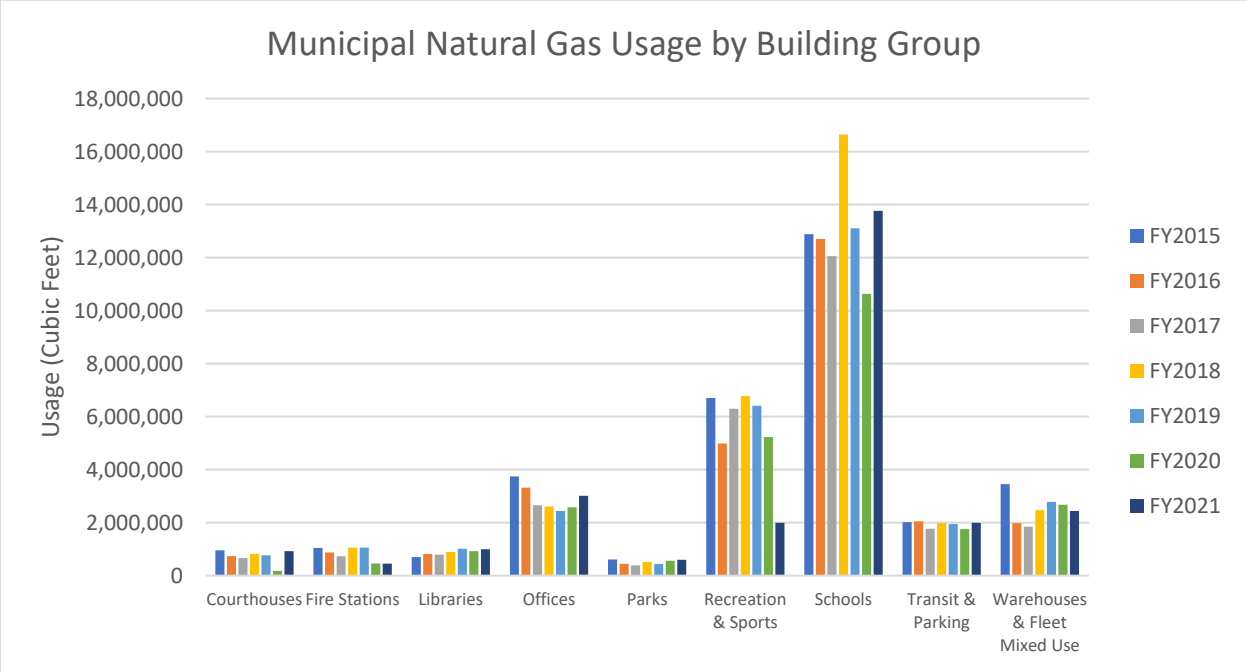



***Figure 6:*** *The City’s natural gas usage for each building group over the past 7 fiscal years.*

## Water and Sewer

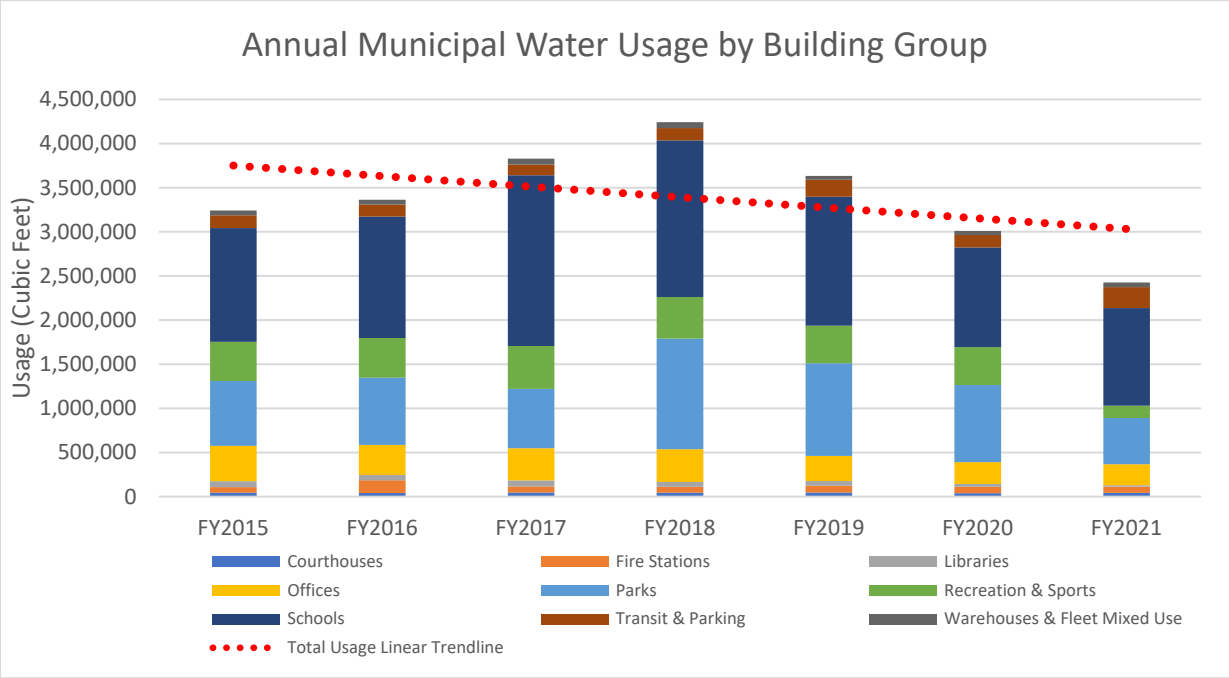



***Figure 7:*** *The City's water usage for the past 7 fiscal years across all City facilities and partitioned out by building group.*

In FY2021, 14% of total utility costs were for water and sewer at City municipal facilities. Water and sewer costs and water consumption have fluctuated over the past seven years with a decline in usage over time particularly from the past 3 fiscal years (Figure 7). When comparing FY2015 (baseline year) water usage to FY2021 usage, there is a 25% decline. This declining rate is more aggressive than the general 2% reduction goal in usage annually with a total 12% decline as the target change for FY2021. There have been a few building groups showing an increase in water and sewer costs and usage that can be associated with the addition of a few new water accounts particularly for irrigation and parks accounts as well as a few large water leaks over the past seven years.

In FY2021, Schools, Parks, Offices, and Transit & Parking building groups were the highest water using building groups (46%, 22%, 10%, and 10% to total usage respectively) (Figure 8). In FY2020, Recreation and Sports building group was one of the highest users; however, due the pandemic shutting down the indoor recreation spaces for a long duration, the Recreation and Sports building group only made up 6% of water usage and saw the largest decline in usage when comparing FY2020 to FY2021. The high water-using building groups were operating closer to pre-pandemic schedules (or at one point during the year) compared to other building groups that had little to no people using these types of buildings. Domestic daily water usage is heavily impacted by the number of people in a building particularly from the use of toilets.

A few building groups did show an increase in usage when comparing FY2021 to FY2020 (Appendix 8.3). This increase was most notably seen in Transit and Parking facilities (69% increase), which was influenced significantly by a large water leak at the Downtown Transit Station. Courthouses and Warehouse facilities also saw an increase when compared to FY2020 usage amounts (11% and 12% respectively). The Courthouse building group increase was the result of an increase in usage at Circuit

Court from a renovation project that added additional toilets to the building (146% increase). The Warehouse building group had increases in the City Yard Wash Facility (44% increase) as well as all buildings had similar or slightly higher usage compared to FY2020 as these facilities continued to be used throughout the pandemic.

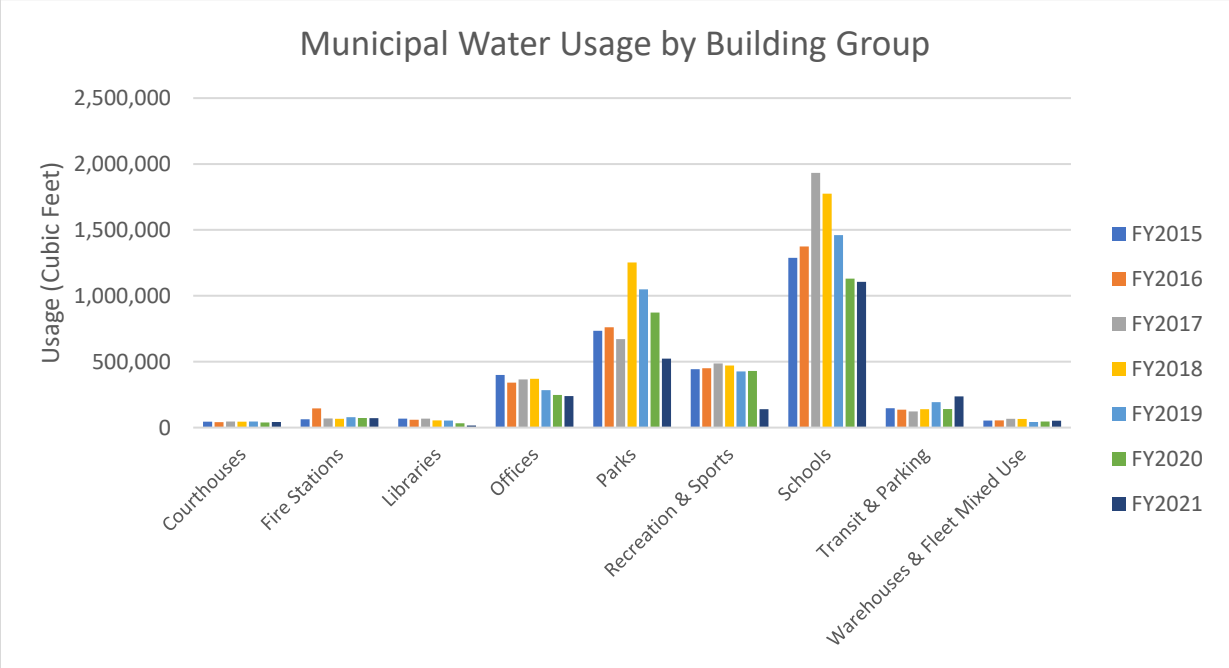
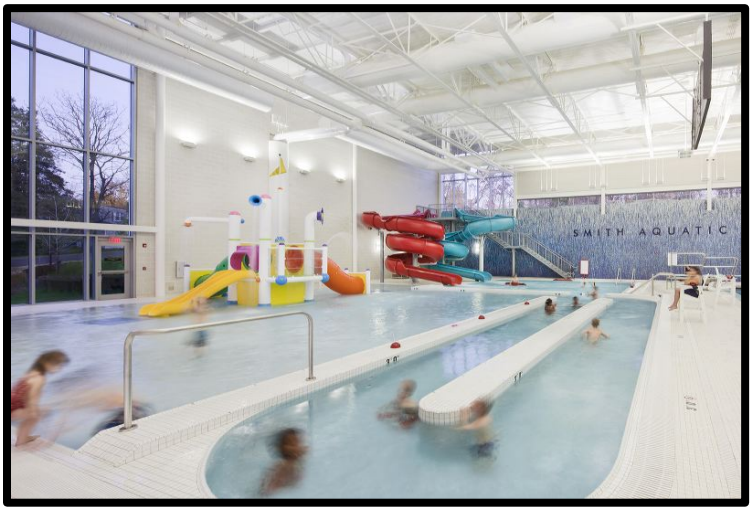



***Figure 8:*** *The City's water usage for each building group over the past 7 fiscal years.*

FY2021 continues with the downward trend and lowest usage over the past seven years (25% decline in usage from FY2015 to FY2021); however, this is still primarily the result of COVID-19 impacting building operations and occupancy. When comparing FY2020 to FY2021, we see a 19% decline in usage and 17% decline in water and sewer costs (Appendix 8.3). The declining trend for usage and costs continues to be attributed primarily to COVID-19 and the resulting changes in use of the facilities. As more buildings start to return to have staff, students, and the community, usage is expected to increase even with COVID-19 still impacting our community.



## Greenhouse Gas Emissions

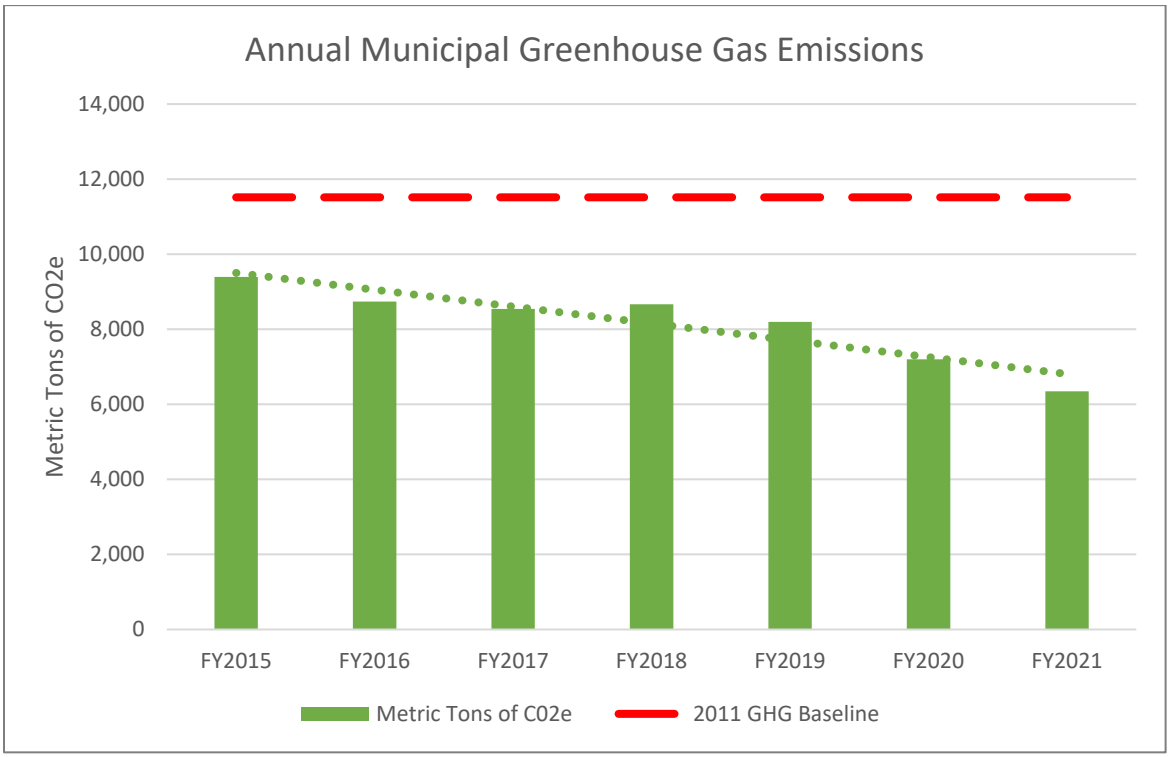



***Figure 9:*** *Greenhouse gas emissions for the past 7 years across all City and school facilities.*

On July 1, 2019, the City of Charlottesville committed to a community-wide greenhouse gas (GHG) reduction goal of 45% below the 2011 inventory year by 2030 and carbon-neutrality by 2050.

Since 2011, the portfolio has seen some fluctuation but mostly a downward trend (9.8% reduction by FY2015 and 36.3% in total by FY2021) in greenhouse gas emissions (Figure 9). This reduction is in part due to the electric grid becoming cleaner (generating energy from cleaner sources), so although electricity usage remained steady (prior to FY2020), the electricity used is producing less emissions. The reduction seen in FY2020 and FY2021 also is attributed to reductions in operations at facilities due to COVID-19, which must be treated as an anomaly. When occupancy begins to return to pre-COVID levels, we can expect to see an

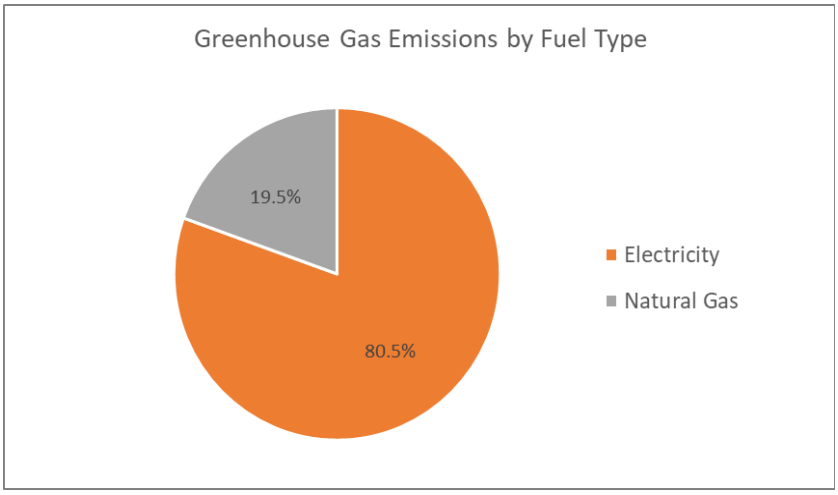



***Figure 10:*** *The City's Greenhouse gas emissions by fuel type (percentage).*

increase in greenhouse gas emissions barring any efficiency improvements and cleaning of the electric grid.

Electricity is the source of most greenhouse gas emissions from City buildings so strategies that reduce electricity have the potential to have the greatest impact on emissions (Figure 10). Electricity is projected to have reduced emissions overtime as renewable sources, such as solar and wind, continue to be installed at the grid-level and onsite. Although advancements are being made in the natural gas industry (e.g., renewable natural gas), its use will likely continue to produce greenhouse gas emissions for the foreseeable future. As stated in the "City of Charlottesville 2016 Greenhouse Gas Inventory", the two options for reducing greenhouse gas emissions are from switching to a fuel source that produces less emissions and from reducing energy use through efficiency and conservation measures. Both approaches will continue to be utilized to reduce the City's greenhouse gas footprint.

## Green Building Certifications

In 2008, the Charlottesville City Council adopted a resolution to implement green building practices for City construction projects (2008 Green Building Resolution). This resolution outlined the use of the USGBC (U.S. Green Building Council) LEED (Leadership in Energy and Environmental Design) program to guide the design and construction of City facilities. As a result, the City has been able to achieve LEED status on numerous building projects (Table 4, View on the interactive CityGreen Map).

***Table 4:*** *Municipal LEED Building Projects.*

| Project | Year | LEED Level |
|---|---|---|
| Downtown Transit Station | 2008 | Gold |
| EcoREMOD | 2009 | Platinum |
| Smith Aquatic Center | 2010 | Platinum |
| Charlottesville Area Transit | 2012 | Gold |
| Facilities Maintenance Building | 2013 | Gold |
| Fontaine Fire Station | 2014 | Platinum |
| Circuit Court - *Renovation* | 2020 | Gold |

The City will continue to use USGBC's LEED as a guide for design and construction projects and will monitor the development of other green building certification programs that could help City projects achieve a greater level of sustainability.

## FY2022 Outlook

With COVID-19's impact still being seen into FY2022, the EWMP will continue to remotely monitor and report on the City's performance. As City facilities open back up to staff and students, it is expected that some utility usage and costs will increase (higher than 2019 reported numbers) as a result of mitigation measures that have been implemented throughout facilities such as enhanced filtration in HVAC systems (including UV and Bi-polar ionization systems) along with portable HEPA filters for mitigation of COVID-19 in most facilities.

The EWMP plans to establish clear utility reduction goals for City facilities that are in line with the City of Charlottesville's greenhouse gas emission reduction goals and Climate Action Plan. The EWMP will continue to review utility performance monthly and investigate opportunities to improve efficiency through operations, technology, and behavior strategies. Through an Energy Savings Performance Contract, the program hopes to identify and tackle a myriad of opportunities to improve efficiency at most of the City facilities and to realize cost savings from these improvements over the life of the contract. Through some form of Power Purchase Agreement (if pursued), the program hopes to realize a shift in electricity generated from solar that saves costs while reducing emissions.

Education and outreach of City staff and students have allowed for considerable progress to be made on energy and water efficiency, and the EWMP is looking forward to continuing this momentum to propel behavioral changes. COVID-19 will continue to be a challenge in FY2022 as building usage and occupancy continues to be variable and different than previous years. The EWMP will continue to research how to best track and normalize for utility changes from COVID-19 so that savings can be more accurately attributed to efficiency improvements from the City's progress.

# Glossary

**Building Automation System (BAS):** A control system in buildings that allows monitoring and control of heating, ventilation, and air conditioning (HVAC) systems, lighting, and other building equipment through a common interface.

**Building Groups:** Building groups are categories of typical use-types of the City's municipal facilities developed by the Energy and Water Management Team to compare similar types of facilities with each other and with national standards (e.g., fire stations, schools, and offices). Specific City facilities within a building group are defined in Appendix 2.

**Benchmarking:** The practice of comparing the measured utility performance of a building over time to itself or relative to other similar buildings.

**Better Business Challenge (BBC):** Local challenge being hosted by the Community Climate Collaborative to bring businesses together to work toward reducing their overall greenhouse gas impact and improve efficiency in their buildings.

**Calendar Year (CY):** Unit of time looking at measurements made from January 1$^{st}$ through December 31$^{st}$ of that year.

**Capital Improvement Project (CIP):** Project requiring capital expenditure and specified approval annually for City and School budgets.

**Charlottesville City Schools (CCS**): Charlottesville City Schools are the City of Charlottesville's public school division. Charlottesville City Schools are a building group in the City facilities portfolio represented as the "Schools" building group.

**City Facilities:** City facilities represents all facilities and buildings that are managed and/or owned by the City of Charlottesville and are included in this report. In this report City and municipal are used synonymously. The City's facilities are listed in their respective building group in Appendix 2.

**Coronavirus (COVID-19):** The coronavirus is an infectious disease that impacted the entire world brought on by a newly discovered coronavirus in 2019, giving it the name COVID-19.

**Cubic Feet (cf):** Unit of measurement used for natural gas and water utility consumption.

**Degree Day:** A measure of how hot or cold outside temperatures are on a particular day compared to a standardized temperature (65$^{o}$F). A cooling degree day is where average temperatures for that day are above the standardized temperature and a heating degree day is where average temperatures are below the standardized temperature. The degree to which these are above or below the temperature are taken into account each day and then accumulated throughout the year to achieve the final cooling and heating degree days for that month or year.

**Department of Mines, Minerals, and Energy (DMME):** Virginia state agency established to facilitate energy, geology, and mining programs within Virginia. DMME is currently called Virginia Energy.

**Energy and Water Management Program (EWMP):** A program run by the Energy and Water Management Team that manages utility usage for all City facilities.

**Energy and Water Management Team (EWMT):** A group of Public Works Department staff with representation from the Facilities Maintenance, Facilities Development, and Environmental Sustainability Divisions that manages and facilitates the Energy and Water Management Program.

**Energy Savings Performance Contract (ESPC):** An agreement between an entity and a contractor (typically an ESCO) to perform building upgrade services that provide guaranteed energy savings.

**Energy Services Company (ESCO):** A contractor that provides the services agreed to in an energy performance contract.

**EnergyCAP:** Software platform used by the City to monitor and manage utility usage and costs.

**ENERGY STAR Score:** An energy performance indicator ranging from 1 to 100 established by the Environmental Protection Agency's (EPA) ENERGY STAR program. This performance indicator compares a building's utility performance to other similar building types with normalization of weather and operational differences (e.g., occupancy, plug load, and operating hours). A higher ENERGY STAR score indicates a better building performance where a score of 50 represents a building with a median energy performance compared to similar building types across the nation.

**Energy Use Intensity (EUI):** The EUI is a measure of how much energy a building uses per square foot. To calculate the EUI, the total energy usage (e.g., electricity and natural gas) is converted to a common unit known as kilo-British thermal units (kBtu) and is then divided by the total square footage of the building. Typical EUIs can range from 40 – 70 kBtu/sf depending on the property type and the lower EUI value, the less energy intensive the facility.

**Fiscal Year (FY):** Unit of time looking at measurements made from July 1$^{st}$ through June 30$^{th}$ of the following calendar year.

**Greenhouse Gas (GHG):** Gases that absorb infrared radiation and contribute to the greenhouse effect (warming) of the Earth. The primary greenhouse gases include water vapor, carbon dioxide, methane, nitrous oxide, and ozone.

**Heating, Ventilation, and Air Conditioning (HVAC):** Equipment or system that controls thermal comfort within a built environment. Includes equipment such as air handlers, chillers, cooling towers, and boilers.

**HVAC Schedules:** Setting that determines when components of the HVAC system turn on and turn off daily.

**Investment Grade Audit (IGA):** Technically the second phase of the ESPC where onsite technical audits are performed at all participating facilities to identify energy/water conservation measures and facility improvement projects to be considered for selection for the overall ESPC project and implementation.

**Kilo British Thermal Units (kBtu):** Unit of measurement for energy. One Btu (British Thermal Unit) is defined as the amount of heat required to raise the temperature of one pound of water by one-degree Fahrenheit. 1 kBtu is equal to 1,000 Btus.

**Kilowatt-hour (kWh):** Unit of measurement for power, the rate at which energy is generated or consumed. Used to measure electricity consumption.

**Light-Emitting Diode (LED):** A semiconductor that emits light when current passes through it. LEDs typically use less energy and last longer than traditional light sources (e.g., incandescent, fluorescent, halogen).

**Leadership in Energy and Environmental Design (LEED):** An internationally accepted green building rating system developed by the US Green Building Council.

**Metric Tons of Carbon Dioxide Equivalent ($MTCO_2e$):** Unit used for aggregating greenhouse gases (e.g., carbon dioxide, methane, nitrous oxide) into one common unit. The global warming potential for each greenhouse gas (how much heat each gas traps in the atmosphere, relative to carbon dioxide) is used to convert the emissions of that gas to a carbon dioxide equivalent measured in metric tons.

**Photo Voltaic (PV) System:** A system that generates electric power by using solar cells to convert sunlight into direct current electricity.

**Solar Power Purchase Agreement (PPA):** A financial agreement with a developer where the developer facilitates the design and installation of a solar system and charges the customer a fixed electricity rate for the power generated, typically below the current market electricity rate. The developer maintains the system through the end of the contract term and at the end, the customer may choose to extend the contract, purchase the system, or have the developer remove it.

**STEM (Science, Technology, Engineering, and Mathematics):** Grade school subject that brings in concepts of science, technology, engineering, and mathematicises together in one academic discipline. At Charlottesville City Schools, this subject is called “iSTEM” which stands for Instructional STEM.

**Weather Normalization:** A method of estimating the impact of weather on energy consumption and adjusting consumption to remove weather variance from year to year. Typically uses degree days (the number of days that exceed or go below a balance point temperature multiplied by the extent to which the daily average deviates from the balance point temperature). If the average temperature is above the balance point, that day would be considered a cooling degree day (CDD). If the average temperature is below the balance point, that day would be considered a heating degree day (HDD).

**WE@Work (Water and Energy at Work):** WE@Work is a program developed by the Energy and Water Management Program focusing on engagement and education of City staff to improve behaviors that could impact energy and water usage in the workplace.

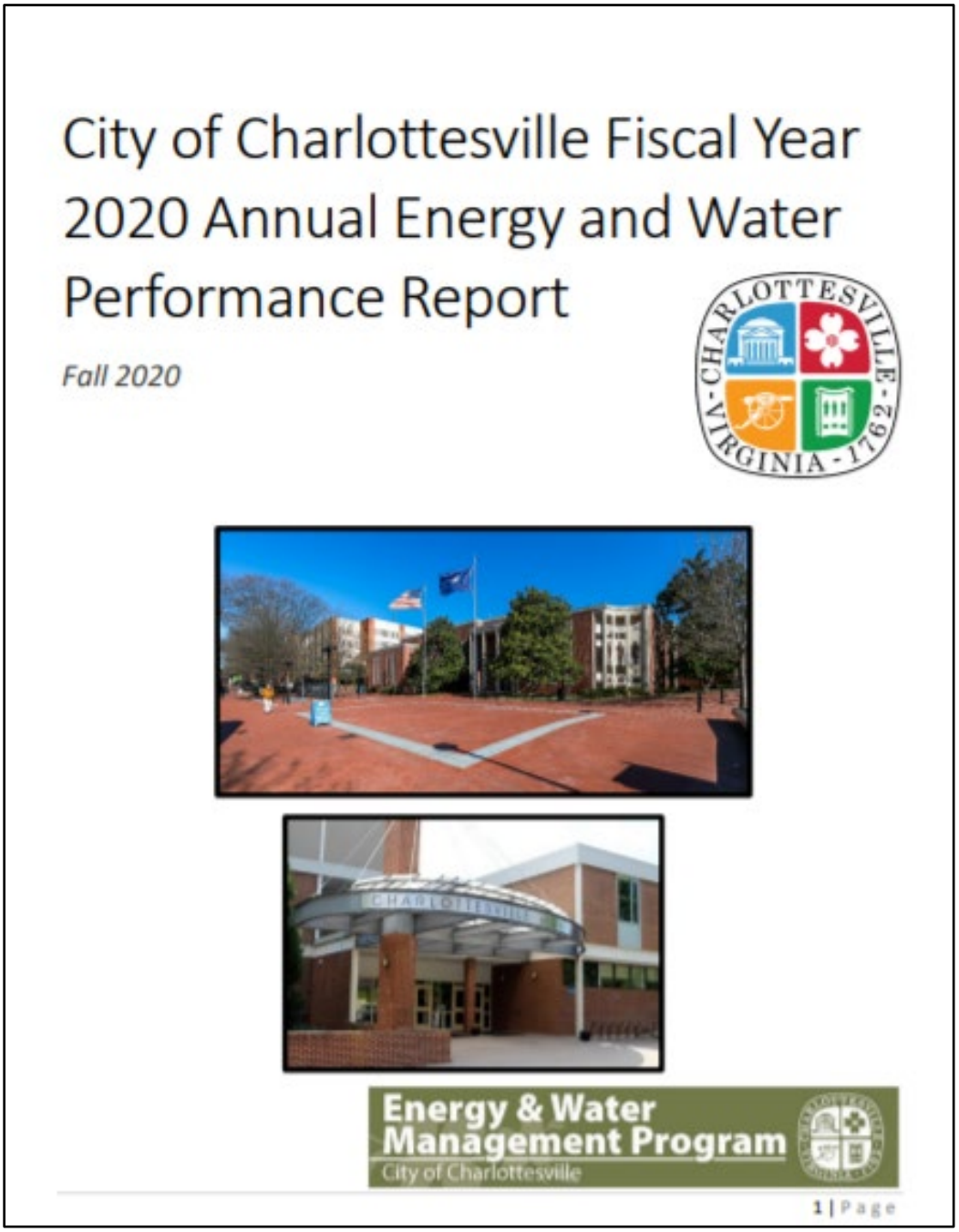
# Appendix

## Appendix 1: FY2020 Annual Energy and Water Performance Report

**City of Charlottesville Fiscal Year 2020 Energy and Water Performance Executive Summary (PDF)**

**City of Charlottesville Fiscal Year 2020 Energy and Water Performance Report (PDF)**

**EnergyCAP City of Charlottesville Fiscal Year 2020 Energy and Water Performance Dashboard (LINK)**



Appendix 2: City of Charlottesville's building groups and specific buildings used and referenced in the report.

# City Building Groups

## Courthouses
- Circuit Court
- Juvenile & Domestic Relations Court

## Fire Stations
- Bypass Firehouse
- Central Fire House
- Fontaine Fire Station

## Libraries
- Central Library
- Gordan Avenue Library

## Offices
- CAFF Office (414 4th St.)
- City Hall Annex
- City Hall Complex
- Community Attention Main Office (909 E Market St.)
- DHS Administration (907 E. Jefferson St.)
- Jessup House
- Levy Building
- Preston-Morris Building
- Promise House (708 Page St.)
- Public Works Administration
- Wheeler Building

## Vehicle Charging
- Police Vehicles Station
- Public Works Station

## Parks
- Azalea Park
- Belmont Park
- City Market
- Court Square Park
- Downtown Mall Fountains
- Fifeville Park
- Forest Hill Park
- Greenleaf Park
- Jordan Park
- Various Landscape Accounts
- Maplewood Cemetery
- Market St. Park
- McGuffey Park
- McIntire Park
- Melbourne Road
- Northeast Park
- Oakwood Cemetery
- Pen Park
- PVCC Field
- Quarry Rd. Baseball Field
- Rives park
- Tonsler Park
- Washington Park Center, Grounds, and Pool

## Transit & Parking
- Downtown Transit Station
- Market St. Parking Garage

## Recreation & Sports
- Carver Center
- Crow Pool/Center
- Key Recreation Center
- McIntire Golf Course
- Meadowcreek Clubhouse and Golf Course
- Onesty Pool
- Smith Aquatic Center

## Schools
- Buford Middle
- Burnley-Moran Elementary
- Charlottesville High School
- Clark Elementary
- Greenbrier Elementary
- Jackson-Via Elementary
- Johnson Elementary
- Lugo-McGinness Academy
- Venable Elementary
- Venable School Annex
- Walker Upper Elementary

## Warehouses & Fleet Mixed Use
- City Yard Warehouse
- City Yard Wash Facility
- Facilities Maintenance
- Public Transportation
- Transit Operation Center

## Street Lights & Traffic Signals
- Multiple Locations

## Appendix 3: City of Charlottesville Energy and Water Management Policy

**City of Charlottesville Energy and Water Management Policy signed July 26, 2019 (Login Required: City of Charlottesville Intranet Website)**

**CITY OF CHARLOTTESVILLE**
**STANDARD OPERATING PROCEDURE**

| | |
|---|---|
| Type of Policy: FISCAL | Policy Number: 200-13 |
| Subject: Energy and Water Management Policy | |
| Circulated for Comment/Approval of Lead Team? Yes | Date: July 11, 2019 |
| | |
| Authorization: Dr. Tarron Richardson, City Manager | |
| Signature of City Manager: | Effective Date: 7.26.19 |

### I. PURPOSE OF POLICY

The intent of this policy is to establish guidelines for the optimization of energy and water performance in City of Charlottesville government facilities and to establish a foundation for the Energy and Water Management Programs. To realize commitments regarding reductions in emissions and resource waste, it is of the greatest importance that government facilities are operated in a manner that is economically and environmentally sustainable. It is the joint responsibility of all employees to implement this policy and support Charlottesville as a Green City.

Effective immediately, it is the policy of the City of Charlottesville that City facility operations, including building operations and occupant behavior, be conducted in the manner prescribed below.

## Appendix 4: Resolution for Charlottesville City Schools Energy and Water Performance

### Resolution for Charlottesville City Schools Energy and Water Performance

***Whereas***, Charlottesville City Schools are committed to personal and academic excellence and preparing all current and future students to be engaged citizens who make contributions to the well-being of their community, including the natural environment; and

***Whereas***, building energy use is a major expense and emitter of greenhouse gases contributing to air pollution and climate change; and

***Whereas***, actions that reduce negative climate and air quality impacts and increase energy efficiencies will also lead to a cleaner environment and a better quality of life for both students and community members; and

***Whereas***, renewable power installations, energy savings initiatives, and fuel-efficient transportation provide an educational opportunity for students and employees for everyday teaching and learning; and

***Whereas***, through practices and partnerships, Charlottesville City Schools strives for optimized energy and water efficiency while balancing equity, economic, and environmental impacts; and

***Whereas***, Charlottesville City Schools has been deliberate and proactive in implementing environmental improvement measures in school operations and taking actions that reduce resource consumption and associated greenhouse gas emissions, including:

- Implementation of a Guaranteed Energy Savings Performance Contract in 2007 to provide energy efficiency and infrastructure upgrades to three schools
- Certification by U.S. Environmental Protection Agency as ENERGY STAR® for seven of nine schools in 2009
- Installation of solar photovoltaic systems on Charlottesville High School and Lugo-McGinness Academy
- Honored by U.S. Department of Education in 2016 with Green Ribbon Schools District Sustainability Award; and

***Whereas***, pursuing energy improvements and cleaner sources of energy is in line with City goals, values, and commitments on climate protection that acknowledge local and global implications; and
Whereas, Charlottesville City Schools aims to reflect and support the goals of the community it serves.

***Therefore be it resolved*** that the Charlottesville City Schools, acknowledging the ongoing partnership with the City of Charlottesville and the reliance on City support in implementing energy and water performance improvement measures, commits to

1. Support improved performance of the school building portfolio through efforts to reduce energy and water use through management, conservation, and efficiency upgrades; and
2. Work with the City to pursue new school buildings that integrate high performance standards related to energy and water; and
3. Partner with City staff to evaluate and pursue opportunities increasing the amount of clean energy used by Charlottesville City Schools, such as through increased onsite renewable energy.

Chair, Charlottesville City School Board

April 11, 2019

Date

**Resolution for Charlottesville City Schools Energy and Water Performance (PDF)**

## Appendix 5: 2020 CCS Annual Energy and Water Performance Report

**2020 CCS Executive Summary and Annual Energy and Water Performance Report (PDF)**

The City of Charlottesville's Energy and Water Management Program (EWMP) monitors and manages energy and water usage at all municipal and school sites. It has continued its strong partnership with Charlottesville City Schools (CCS) set in place by the energy and water saving goals in the 2019 Resolution for Charlottesville City Schools Energy and Water Performance. This 2020 report expands on information presented in the Charlottesville City Schools 2019 Annual Energy and Water Performance Report and gives an overview of actions and the energy and water performance of the schools in the 2020 calendar year. The EWMP has set a general guide of a 2% reduction in utility consumption at each school to help provide an attainable goal and means of comparison from a school's previous year performance.

The year 2020 will forever be a unique year for the world due to the Coronavirus (COVID-19) and the impact it had on building performance. COVID-19 is a large part of the story in this 2020 report as it impacted an essential driver in energy and water use: building occupancy. In 2020, the school portfolio spent just over $900,000 on energy and water utilities, which was well below a typical year where CCS spends closer to $1.2 million annually. Even with utility rates increasing, the portfolio saw a significant decline in cost because of the COVID-19 response which caused all CCS facilities to be shut down for a portion of 2020 and then run at reduced occupancy. CCS saw a 19% decline in electricity usage, a 9% decline in natural gas usage, and a 36% decline in water usage compared to the portfolio baseline year of 2015. The majority (approximately 66%) of the utility savings came from electric costs with an estimated $230,361 saved when comparing 2020 to 2019 electricity costs. Water and sewer also saw a large decline in costs and contributed 25% of total savings and estimated just over $87,000 saved from utility costs when comparing 2020 to 2019. The largest total utility savings occurred during April and May of 2020, when facilities were almost completely shut down as a result of COVID-19.

The average ENERGY STAR score across the CCS portfolio in 2020 was 67 (54 in 2019) and the average EUI was 48.9 kBtu/sq.ft. (65.3 kBtu/sq.ft. in 2019). Again, the reduction in the EUI and increase in the ENERGY STAR score last year was mainly due to reduced occupancy and operations in schools due to COVID-19 response. Although there were likely improvements in efficiency that contributed to this, the Energy and Water Management Team (EWMT) attributes most of the energy reductions to the changes in operations and can expect energy usage to increase back to pre-COVID-19 levels when "normal" school operations resume. The EWMT is consulting ENERGY STAR recommendations for adjusting the attributes that generate the score for each facility to account for the reduced operations in 2020 and to help normalize the ENERGY STAR score, making the score more legitimate as a representation of operational efficiency.

The CCS portfolio had seen a downward trend in greenhouse gas (GHG) emissions and then a leveling off from 2015 to 2019, but with the major reductions seen in energy usage at CCS facilities in 2020 due to COVID-19, GHG emissions saw a sharp decline (28.0%). Given that the large reduction in GHG emissions seen in 2020 was from responses to COVID-19 rather than actual efficiency gains, they do not give an accurate picture of progress toward the City's greenhouse gas reduction goal. The treatment of the data to normalize for this anomaly year is still being determined.

**2020 CCS Performance Report Dashboard**

A Dashboard of all the data included in the 2020 Annual Performance Report with interactive options and detailed data can be viewed at

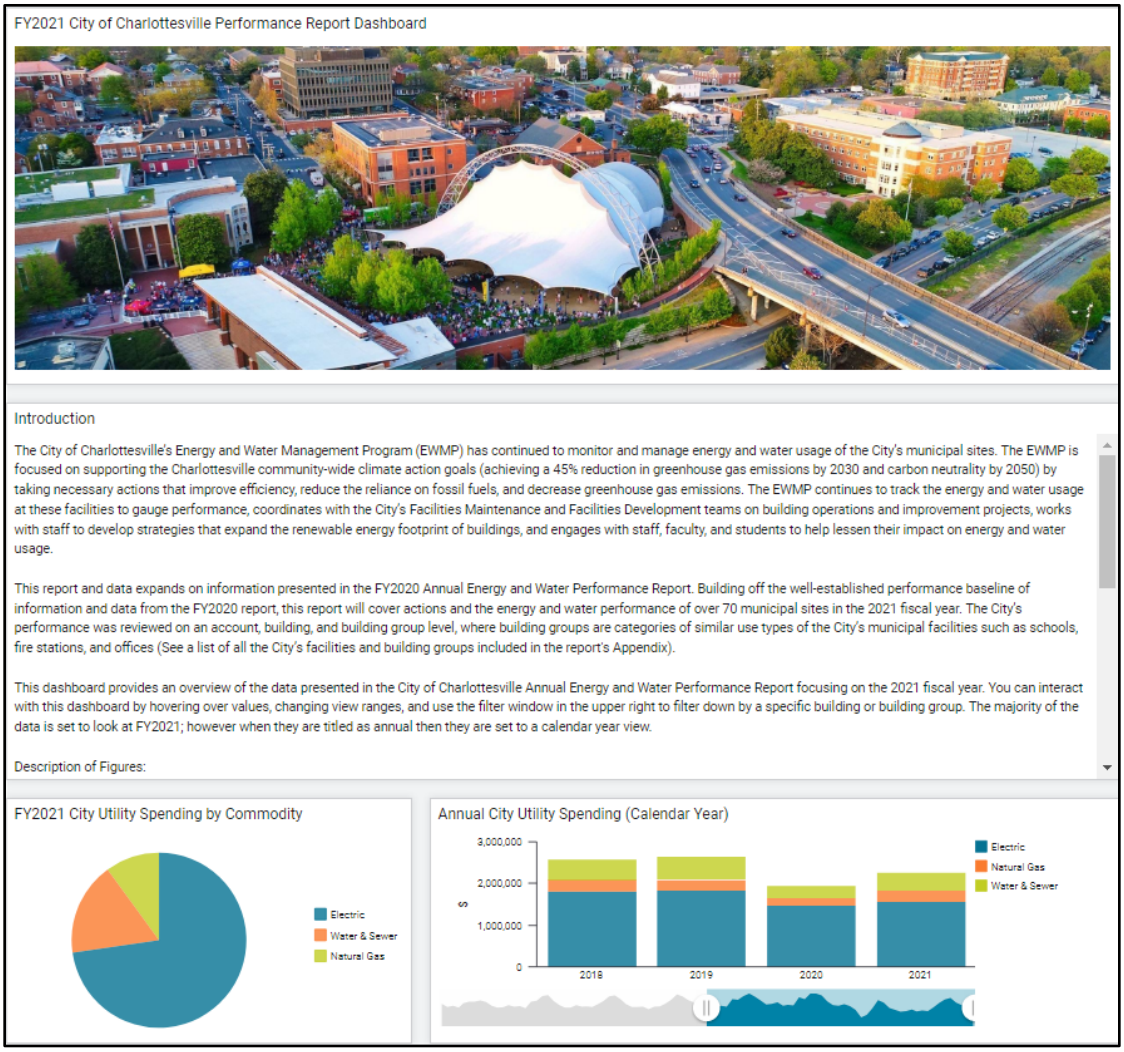
## Appendix 6: EnergyCAP Dashboard info & Link

**EnergyCAP FY2021 City Performance Report Dashboard Link**

*(Try opening dashboard using Chrome web browser for best results)*

This dashboard is an interactive option for viewing the data put forth in this report using the EWMT utility tracking software, EnergyCAP. The figures in this dashboard are all slight variations of the data provided in this report. The data in this dashboard are for all City facilities; however, you can further filter the data specific for one facility using the "Filter by building or building group" feature in the upper right. Start typing the name of the facility or building group (from Appendix 2) and select the correct name from the auto-generated list and the data will update with your new filtered view. Many of the figures and graphs offer the ability to interact including hovering over the figures to get detailed information and changing time views of the data using the slide bar above or below a graph. Most data presented in these figures are static and are focused on FY2021; however, a few are continually updated with data over time but still include FY2021 numbers and some are showing calendar year views, not fiscal year.

Any questions about this data or dashboard can be directed to EnergyWaterTeam@charlottesville.gov.



## Appendix 7: City Benchmarked Facilities and ENERGY STAR Scores

| Facilities | ENERGY STAR Score* | | |
|---|---|---|---|
| | FY2015 | FY2020 | FY2021 |
| Buford Middle School | 43 | 59 | 59 |
| Burnley-Moran Elementary School *(ES Cert. 2009)* | 33 | 72 | 68 |
| Bypass Firehouse | 202.1 kBtu/sf | 176.3 kBtu/sf | 197.3 kBtu/sf |
| Central Fire House | 157.8 kBtu/sf | 121.0 kBtu/sf | 114.6 kBtu/sf |
| Central Library | 192.9 kBtu/sf | 177.4 kBtu/sf | 183.2 kBtu/sf |
| Charlottesville High School *(ES Cert. 2009)* | 71 | 68 | 69 |
| Circuit Court | 39 | 99 | 57 |
| City Hall Annex | 39 | 40 | 38 |
| City Hall Complex *(ES Cert. 2009)* | 81 | 89 | 91 |
| Clark Elementary School *(ES Cert. 2009)* | 37 | 54 | 55 |
| Community Attention Main Office (909 E Market St.) | 39 | 42 | 38 |
| CAFF Office (414 4th St.) | 84 | 87 | 87 |
| Crow Pool/Center | 342.6 kBtu/sf | 280.8 kBtu/sf | 183.6 kBtu/sf |
| Downtown Transit Station | 54 | 55 | 68 |
| Facilities Maintenance | 99 | 99 | 96 |
| Fontaine Fire Station | 121.2 kBtu/sf | 124.1 kBtu/sf | 125.1 kBtu/sf |
| Gordon Avenue Library | 136.3 kBtu/sf | 96.2 kBtu/sf | 101.4 kBtu/sf |
| Greenbrier Elementary School *(ES Cert. 2009)* | 51 | 70 | 67 |
| DHS Administration (907 E Jefferson St.) | 40 | 74 | 75 |
| Jackson-Via Elementary School *(ES Cert. 2009)* | 65 | 70 | 67 |
| Jessup House | * | 80 | 91 |
| Johnson Elementary School *(ES Cert. 2009)* | 71 | 76 | 78 |
| Juvenile & Domestic Relations Court | 46 | 48 | 51 |
| Key Recreation Center | 99.0 kBtu/sf | 90.9 kBtu/sf | 56.4 kBtu/sf |
| Lugo-McGinness Academy | 82 | 93 | 96 |
| Market St Parking Garage | 63.7 kBtu/sf | 64.1 kBtu/sf | 63.3 kBtu/sf |
| Onesty Pool | 239.4 kBtu/sf | 228.9 kBtu/sf | 69.5 kBtu/sf |
| Preston-Morris Building | 70 | 86 | 82 |
| Public Works Administration | 73 | 86 | 86 |
| Pupil Transportation | 99 | 99 | 100 |
| Smith Aquatic Center | 656.3 kBtu/sf | 439.4 kBtu/sf | 77.7 kBtu/sf |
| Tonsler Park | 107 kBtu/sf | 139.7 kBtu/sf | 164.9 kBtu/sf |
| Transit Operation Center | 149.5 kBtu/sf | 140.6 kBtu/sf | 127.5 kBtu/sf |
| Venable Elementary School | 52 | 62 | 63 |
| Venable School Annex | 1 | 3 | 56 |
| Walker Upper Elementary School | 40 | 41 | 30 |
| Wheeler Building | 41 | 56 | 55 |

* Property types that aren't eligible for ENERGY STAR scores use weather normalized source EUI (kBtu/sf) in Portfolio Manager.

## Appendix 8: Detailed Utility Usage and Costs for FY2020 and FY2021

***Appendix 8.1:*** *City of Charlottesville's electric usage and costs for each building group in FY2020 and FY2021 with percent comparison.*

| Building Group | Electricity (kWh) | | | Electricity Cost | | |
|---|---|---|---|---|---|---|
| | FY2020 | FY2021 | % Change | FY2020 | FY2021 | % Change |
| Courthouses | 528,734 | 640,141 | 21% | $52,675 | $60,595 | 15% |
| Fire Stations | 719,459 | 744,474 | 3% | $60,440 | $59,779 | -1% |
| Libraries | 564,077 | 604,718 | 7% | $54,553 | $54,176 | -1% |
| Offices | 2,597,229 | 2,499,116 | -4% | $230,908 | $208,635 | -10% |
| Parks | 519,113 | 453,870 | -13% | $57,083 | $48,122 | -16% |
| Recreation & Sports | 2,130,511 | 1,028,161 | -52% | $194,961 | $114,321 | -41% |
| Schools | 8,256,973 | 8,042,006 | -3% | $814,744 | $774,897 | -5% |
| Street Lights & Traffic Signals | 3,316,262 | 3,280,737 | -1% | $580,779 | $570,420 | -2% |
| Transit & Parking | 1,222,034 | 1,168,477 | -4% | $108,434 | $97,401 | -10% |
| Vehicle Charging Stations | 3,716 | 3,219 | -13% | $547 | $486 | -11% |
| Warehouses & Fleet Mixed Use | 668,673 | 629,072 | -6% | $62,851 | $57,212 | -9% |
| **Total** | **20,526,781** | **19,093,990** | **-7%** | **$2,217,976** | **$2,046,044** | **-8%** |

*Note that some accounts for Streetlights/Traffic Signals have been estimated where historical data needs to be obtained but will be included in future reporting as data is compiled.

***Appendix 8.2:*** *City of Charlottesville's natural gas usage and costs for each building group in FY2020 and FY2021 with percent comparison.*

| Building Group | Natural Gas (cubic feet) | | | Natural Gas Cost | | |
|---|---|---|---|---|---|---|
| | FY2020 | FY2021 | % Change | FY2020 | FY2021 | % Change |
| Courthouses | 181,600 | 921,300 | 407% | $1,580 | $8,292 | 425% |
| Fire Stations | 455,957 | 452,103 | -1% | $4,129 | $4,099 | -1% |
| Libraries | 920,730 | 993,816 | 8% | $7,344 | $8,166 | 11% |
| Offices | 2,576,994 | 3,010,337 | 17% | $20,702 | $24,241 | 17% |
| Parks | 558,493 | 599,445 | 7% | $5,142 | $5,720 | 11% |
| Recreation & Sports | 5,226,610 | 1,995,093 | -62% | $39,811 | $16,295 | -59% |
| Schools | 10,633,307 | 13,764,411 | 29% | $83,357 | $105,653 | 27% |
| Street Lights & Traffic Signals | - | - | - | - | - | - |
| Transit & Parking | 1,754,500 | 1,989,500 | 13% | $13,429 | $15,844 | 18% |
| Vehicle Charging Stations | - | - | - | - | - | - |
| Warehouses & Fleet Mixed Use | 2,673,632 | 2,441,511 | -9% | $22,583 | $20,582 | -9% |
| **Total** | **24,981,823** | **26,167,515** | **5%** | **$198,077** | **$208,893** | **5%** |

***Appendix 8.3:*** *City of Charlottesville's water usage and costs (water and sewer) for each building group in FY2020 and FY2021 with percent comparison.*

| Building Group | Water Use (cubic feet) | | | Water & Sewer Cost | | |
|---|---|---|---|---|---|---|
| | FY2020 | FY2021 | % Change | FY2020 | FY2021 | % Change |
| Courthouses | 38,203 | 42,508 | 11% | $6,961 | $7,508 | 8% |
| Fire Stations | 72,971 | 71,050 | -3% | $13,107 | $12,919 | -1% |
| Libraries | 32,186 | 15,280 | -53% | $5,452 | $3,163 | -42% |
| Offices | 247,772 | 238,624 | -4% | $39,432 | $38,384 | -3% |
| Parks | 872,838 | 523,656 | -40% | $117,844 | $75,096 | -36% |
| Recreation & Sports | 429,574 | 138,970 | -68% | $52,160 | $18,335 | -65% |
| Schools | 1,130,551 | 1,106,369 | -2% | $164,278 | $159,158 | -3% |
| Street Lights & Traffic Signals | - | - | - | - | - | - |
| Transit & Parking | 140,221 | 237,047 | 69% | $20,447 | $33,521 | 64% |
| Vehicle Charging Stations | - | - | - | - | - | - |
| Warehouses & Fleet Mixed Use | 46,194 | 51,917 | 12% | $6,847 | $7,905 | 15% |
| **Total** | **3,010,510** | **2,425,421** | **-19%** | **$426,526** | **$355,989** | **-17%** |