

City of Charlottesville Fiscal Year 2022 Annual Energy and Water Performance Report

Fall 2022



**Energy & Water
Management Program**
City of Charlottesville



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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, including both local government and public schools. By taking necessary actions that improve efficiency, reduce the reliance on fossil fuels, and decrease greenhouse gas emissions from municipal sites, the EWMP is focused on supporting Charlottesville’s community-wide climate action goals to achieve a 45% reduction in greenhouse gas emissions by 2030 and carbon neutrality by 2050. 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 2022 fiscal year (July 2021 – June 2022). 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.

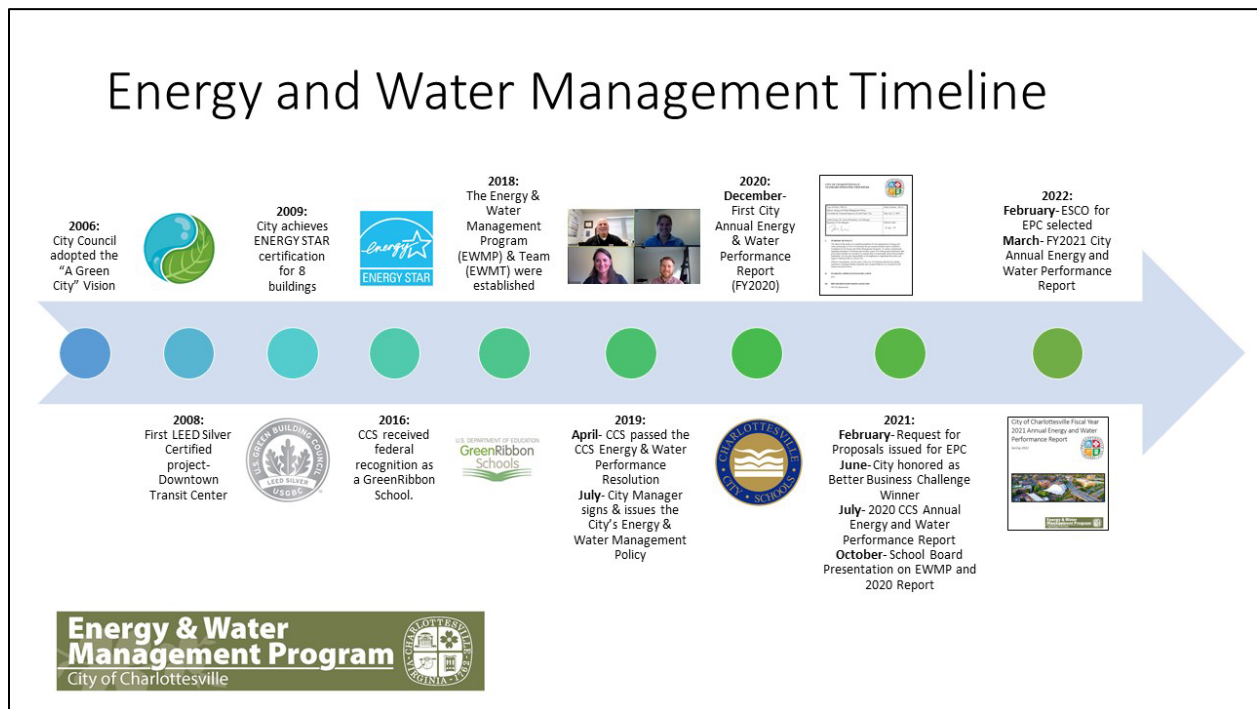


Image 1: Timeline of important events and initiatives around energy and water management efforts in the City of Charlottesville leading up to this report (Appendix 1, Appendix 3, Appendix 4)

COVID-19 Influence

As the Coronavirus (COVID-19) moves into its endemic phase in the world, there are still lingering effects on our building operations and building occupancy which continue to influence performance. Charlottesville City Schools were back to in-person learning for FY2022. City facilities also had more

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building occupancy; however, some were not at full occupancy. The impact on the City's performance by these partially occupied buildings and changes in building operations to increase ventilation is further explored in the *Performance* section of this report.

COVID-19 continues to be part of the story in this FY2022 report as it continues to influence building occupancy and operations. However, in FY2022, building performance started to look more like pre-COVID-19 performance numbers. As a result, changes in usage and costs when comparing FY2021 to FY2022 show large increases as FY2021 included a large portion of time when buildings operated under low to no building occupancy conditions. The EWMP will continue to explore how to handle COVID-19 impact in the City's portfolio performance.

Actions and Performance

Building off previously published data and information (Appendix 1 & Appendix 5), this report explores results and trends in FY2022 utility usage and cost data. The report incorporates the three focus areas identified to improve energy and water performance: operations, technology, and people.



Operations

The efficient operations of facilities represent the lowest cost but potentially the highest impact opportunities for achieving energy and water reductions, an area the City continues to emphasize. Efficient operations can be realized by reviewing the control and maintenance of heating, ventilation, and air conditioning (HVAC) systems and lighting in facilities. Aligning this with the current needs of building occupants with the goal of running equipment optimally and efficiently eliminates unnecessary operations.

Although, across the facility portfolio, occupancy was still lower than before COVID-19, some facilities did see an increase in occupancy in FY2022. With the mixture of occupied and unoccupied statuses, varying within facilities over the course of the year, a new challenge of turning off portions of buildings that were unoccupied while supplying necessary cooling and heating to occupied areas arose, limited by HVAC system design and control capabilities. Where in the past whole buildings were occupied for more or less the same amount of time each day and required less control of specific spaces independent of the rest of the building, meaning shutting off full HVAC for portions of the building while still running others, varied occupancy presented a scenario that called for more nuance control that was beyond many system capabilities. This required testing of system settings to see if setbacks could be employed that affected operations in unoccupied areas while still allowing the main systems to continue operating normally. The Facilities Maintenance Division reviewed building automation system (BAS) data in City and school facilities to find areas where this could be implemented.

In addition to this effort, the Energy and Water Management Team (EWMT) coordinated monthly with Facilities Maintenance representatives to communicate any findings from monitoring energy and water data, providing another set of eyes on how facilities were “behaving” as operating schedules continued to fluctuate throughout the year. The EWMT also continued monthly meetings with CCS administrative staff and quarterly communications with school principals to update on school performance, projects, and outreach strategies and to understand ongoing school activities and operational needs.

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. Similar to FY2021, the balance of safety and energy efficiency was a key aspect of operations in FY2022.

Strategies Implemented

Reviewing HVAC Schedules and BAS Settings to Eliminate Unnecessary Operation

Effective scheduling of HVAC systems means meeting occupant comfort needs while operating only the equipment necessary to serve the occupied areas. As mentioned above, it is not easy to do this in every facility. It depends on the location of occupants in the facility, HVAC zoning throughout the facility (HVAC design and BAS settings), and proper communication about what areas are occupied. In FY2022, many facilities in the City remained partially occupied, presenting scenarios that pushed the limits of system and controls capabilities. Facilities Maintenance reviewed the BAS to adjust settings, such as temperature setbacks, to scale back operations where possible. Buildings behave differently to changing temperature conditions due to age and design, that cause varied abilities to maintain space temperatures and comfort throughout a facility. The team manages these variances effectively to try to keep uniform space temperatures so that comfort can be maintained without wasting energy.

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As occupancy begins to rise within facilities and schedules become more consistent across entire buildings, it will become much easier to limit wasted energy due to HVAC operations. Schools were mostly occupied and operating normally in FY2022 which made this easier to control but City buildings continue to vary in occupancy. School staff, City staff, and Facilities Maintenance continue to maintain good lines of communication regarding the needs of each municipal and school facility at any given time.

Demand-side Management – Load Shedding

Building automation systems (BAS) are a management tool that are installed in many City and School buildings. The City has implemented the programming of 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 EWMP continues to work with Facilities Maintenance to fine-tune the appropriate settings that trigger load-shedding events. The EWMP is evaluating the integration of this strategy at more facilities.

Strategies Planned/FY2023 Outlook

The EWMP will continue to monitor utilities and building operations to ensure that systems are only running when necessary. School operations during FY2022 had mostly returned to a typical pre-COVID schedule and should continue to remain this way into FY2023, barring any necessary changes. Municipal buildings could see a rise in occupancy as more employees pivot to in-person work in FY2023. For the foreseeable future, City and School facilities will continue to have additional ventilation time outside occupied hours for COVID-19 mitigation, so electricity and natural gas usage will likely have an elevated base level compared to pre-COVID. This is to be expected and puts emphasis on balancing health strategies and managing energy usage through appropriate monitoring and scheduling operations.



Technology

Building equipment like HVAC, BAS/control systems, lighting, and plumbing fixtures continue to increase in efficiency and offer 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 goal of improving the efficiency of facilities. The existing funding mechanisms have allowed for gradual upgrades of equipment over time that address equipment efficiency. Although some construction projects were placed on hold due to funding, the City has continued to make strides in improving equipment and building system efficiency.

The EWMP 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. Several viewable EnergyCAP dashboards are available to various groups in the City. The data provided in this report can also be viewable and interacted with in an EnergyCAP dashboard outlined and accessible in Appendix 5.

Strategies Implemented

Installation of LED Lighting

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

In FY2022, the City moved forward with a few projects that removed inefficient lighting from facilities and replaced with lighting that improved energy efficiency, lighting performance, and overall occupant satisfaction. At the Charlottesville Area Transit (CAT) Transit Operations Center, high intensity discharge (HID) lighting in the fleet service warehouse and along the outside of the bus fueling station were replaced with LEDs in overhead and wall pack applications. A project replacing T8 fluorescent lighting in the main floor of the Central Library with linear LEDs was started in FY2021 and completed in FY2022. At Charlottesville High School, LEDs were installed to replace high output ceiling lighting in the main gym and overhead lighting in all stairwells. Along the outside of Buford Middle School, inefficient HID wallpack fixtures were replaced with LED wallpacks, and additional LED lighting was installed where needed. Currently, LED fixtures are being installed on an ongoing basis in Gordon Avenue Library office areas and in parking lot pole lighting in the CAT Transit Operations Center with completion projected in FY2023.

Ongoing modernization and fit-out projects include upgrades to the lighting and lighting controls where feasible. Renovations in the City Attorney's suite in City Hall and the restrooms in the City Yard Warehouse included LED flat panel lighting and occupancy/vacancy sensors. A modernization project in the lower-level offices at Market Street Parking Garage also included LED lighting and expanded lighting controls but is slated to be completed in FY2023. 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 and is primarily focused on older equipment that is reaching the end of its useful life. In

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FY2022, the Facilities Maintenance team wrapped up some HVAC projects that were initiated in FY2021. The team completed the replacement of a make-up air unit at Walker Upper Elementary and an air handling unit at Central Fire Station. Twenty-two console units were replaced at Buford Middle, Clark Elementary, Greenbrier Elementary, Venable Elementary, and Walker Upper Elementary. Smith Aquatics Center underwent a major HVAC renovation that was completed in FY2022 that will ultimately improve comfort and functionality and reduce facility energy usage.

On the building controls side, Venable Elementary received an updated BAS, transitioning from a legacy system that was not supported anymore to an Alerton system that aligns with what is installed at most schools in the City's portfolio. Although not included in this report since the City does not track or pay for the utilities, Charlottesville-Albemarle Technical Education Center (CATEC) also received an updated and more advanced BAS in FY2022.

Facilities Maintenance began additional projects in FY2022; these will be highlighted in the FY2023 report. These include upgrades to the BAS at Clark Elementary and City Hall and replacement of air handling units at Walker Upper Elementary.

Project Rebate Programs Through the PJM Regional Transmission Organization

The City 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
FY2020	\$1,429.47
FY2021	\$1,304.93
FY2022	\$1,791.92

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

Energy Performance Contract (EPC)

In FY2021 the City began the request for proposal (RFP) process to identify an energy services company (ESCO) to be selected for an energy performance contract (EPC). This project delivery model can involve alternative methods for financing and implementing efficiency projects. Projects can be scoped as a budget-neutral approach whereby an ESCO identifies and implements energy and water savings projects with a guaranteed annual utility savings that covers the cost of the projects.

In FY2022, the City selected an ESCO and began the process of performing technical energy audits of over 40 facilities to identify energy and water savings opportunities through upgrading HVAC, lighting, and water-using equipment. Additionally, the ESCO evaluated the solar potential at sites to identify

appropriate areas to consider new solar photovoltaic installations. Details regarding the final scope of the EPC continue to be developed as the Technical Energy Audit reports are finalized. These efforts are anticipated to enable vital upgrades that improve the energy and water efficiency of facilities on a large scale and at a faster pace than through the existing Capital Improvement Project (CIP) funded programs.

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. In FY2022, the City Yard Warehouse had a male and female restroom updated with WaterSense labeled fixtures including the toilets in the women's restroom (1.28 gallons per flush) and urinals in the men's restroom (0.5 gallons per flush). In addition, the faucets in both restrooms use 0.5 gallons per minute.

Strategies Planned/FY2023 Outlook

Looking into FY2023, 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. Both a cooling tower and an outside air unit will be replaced at Venable Elementary and a modernization project at Greenbrier Elementary will likely include LED installations.

The City is also working with Dominion Energy to upgrade the exterior park lighting at Tonsler Park to LEDs. This will be a first time tackling an entire area in a single project with Dominion and will be a pilot for the process in upgrading other Dominion lighting across the City.

The City will receive the Technical Energy Audit reports for the EPC in Fall 2022 and will then be working to finalize the scope and the details of the project. Once this is finalized, the next stage will be planning implementation and construction, which could start in FY2023. The EPC will be a key method in reducing greenhouse gas emissions from the municipal and school building portfolios and in achieving the City's greenhouse gas reduction goals.



People (Behavior)

The people that use and interact with a facility have a significant impact on that facility's performance. The EWMP seeks to engage with occupants of all ages and use types to empower them to contribute to the efficient performance of the facility. A primary strategy the EWMP utilizes to connect with the people that use these facilities is 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 EWMP 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 FY2022, 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 2). This messaging was paired with information about hot and cold comfort issues and a reminder of the work order process to notify Facilities Maintenance staff of the issue rather than occupants trying and mask it with a space heater, which ultimately causes more heating and cooling issues for the space. During the holidays, the EWMP 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 3). The EWMP also connected with CCS custodial staff around turning off lights and reporting water leak issues during their daily rounds at the schools and encouraged them to let the EWMP know of any consistent issues around energy and water.



Images 2: Image used in email/Employee News Flash announcements reminding staff to not use space heaters. **Image 3:** Image used in the Employee News Flash to unplug and shut down electronics and other conservation actions before the holiday break.

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Energy and Water Management Campaign at CCS

CCS Energy and Water Management Program Fall 2021 Focus

Now that you are back at school, it is time to take what you learned last year saving energy and water at home and apply it to your school!

Last school year you made up your own energy and water saving actions, did those actions at home, and learned how to make those actions be your new normal. Now as you return to school, we need you to bring your energy and water saving actions to the classroom.

My Water Saving Action Is: _____

My Energy Saving Action Is: _____

REFLECT

As a class, share your Water and Energy Saving Actions with each other and feel free to share your story from your [Summer Activity Sheet](#). Now as a class, brainstorm and select which actions you want to commit to doing in the classroom this school year.

BRAINSTORM: WATER AND ENERGY SAVING ACTION IDEAS

As a class, discuss how you plan to make sure you will do these water and energy saving actions at school by coming up with an Action Plan. Remember to check the [Winter 2020 Activity Sheet](#) for Water and Energy Saving Action ideas.

WATER SAVING ACTION IDEAS

- Turn off the faucet** when you wash your hands
- Bring a reusable water bottle** Stop using single-use plastic
- Leak check!** Check and look for leaks at school and report them to a teacher

Water plants with leftover or collected water
Before emptying your water bottle, use it to water any plants in the classroom or if your classroom has an outside garden use a bucket to collect rainwater for watering

ENERGY SAVING ACTION IDEAS

- Turn off the lights** Remember to flip the switch when you leave a classroom
- Close doors and windows** Keep outside doors and windows closed when AC or heat is running
- Unplug at the end** when you are done with any electronics

Energy free day
Talk to your teacher about going low tech in the classroom one day a month where you try not to use any or minimal energy (this is a great day to learn outside!)

CCS Energy and Water Management Program Winter 2021-2022 Focus

PUT NUMBERS TO YOUR ACTIONS AND CALCULATE YOUR SAVINGS AT SCHOOL!

Help calculate how much energy and water you are saving in your classroom or even for your entire school!

You and your class hopefully have some great energy and water saving actions put in place to do each day. These actions might only save a little a day for each person, but the savings will add up when you look across all students for an entire school year! This quarter you can track or estimate how much energy and water you are using and see how you can help make a difference at school!

WINTER ENERGY AND WATER SAVING TIPS

- Don't forget to do your energy and water saving actions at home and at school.
- Track your energy and water usage to find out your impact.
- Small energy and water saving actions can still mean big savings!
- If you see an issue like a water leak or a door being kept open, get help from a teacher.

WHAT IS AN ENERGY AND WATER AUDIT?

An audit is performed on a building or specific space and involves a survey, inspection, and analysis of the area's energy and water usage. Audits can help find areas that need to be improved to increase efficiency.

TRACK YOUR SCHOOL'S ENERGY AND WATER USAGE:

- [Energy and Water Dashboard](#) - search your school to see your school's utility usage and utility costs.
- Your teacher will give you some questions and discussion points on the information and graphs in this dashboard.

CHECK OUT THIS WATER CALCULATOR FOR YOUR HOME:

- Take your water investigation home and use this home water calculator to see how much water you use and how you compare to other homes in your area!

Home Water Calculator: <https://home-water-works.org/calculator>

- How are your water saving actions impacting your home water usage?

CCS Energy and Water Management Program Spring 2022 Focus - Understand the Source!

Understanding the source of the resources that give you electricity, heat, and water to drink is important to understanding why it is important to only use what we need.

This Spring, let's get to know our energy and water sources and how we can identify renewable sources over nonrenewable sources. No matter the source, it is important to always remember to only use what we need!

TIPS AND REMINDERS:

- Only use what you need
- Turn to **renewables** when you need energy or water

ENERGY

We need energy to power your electronics, give us light at school, and keep our homes warm during the winter. Energy can come from nonrenewable and renewable energy sources found in nature. **Nonrenewable energy sources** are sources that cannot be easily replenished like coal, oil, and natural gas. You often hear these sources called "fossil fuels". **Renewable energy** comes from natural sources that never run out, like the wind, sun and water. Although renewable resources can change form (like water changing to steam) they never disappear completely - they are recycled in nature.

WATER

We need water to drink, grow food, make our clothes, and much more! The water that we are using is the same water that dinosaurs drank - that is because the water on earth is continuously recycled (thanks to the water cycle) making it a renewable resource. However, only 3% of all the water in the world is freshwater available to everyone to use, and access to this 3% of freshwater is not equally available to everyone.

WHERE DOES ENERGY AND WATER COME FROM THAT YOU USE AT SCHOOL OR HOME?

In Charlottesville, our energy comes primarily from fossil fuels (coal or natural gas - nonrenewable sources) or solar (renewable source). In the City of Charlottesville, our water comes from surface water collected in Sugar Hollow that runs to Ragged Mountain Reservoir or comes down the Rivanna River to South Fork Rivanna Reservoir.

CCS Energy and Water Management Program Summer 2022 Focus

PUT NUMBERS TO YOUR ACTIONS AND CALCULATE YOUR SAVINGS AT HOME!

This summer you can refocus on saving energy and water at home. First make sure all your great energy and water saving actions are still being done and then do an energy and water audit to see how much your actions are saving you!

SUMMER ENERGY AND WATER SAVING TIPS

- Don't leave the water running!** When you're brushing your teeth, try not to leave the water running the whole time. Also, make sure you turn the faucet all the way off when you're done to keep it from dripping.
- Plants need water, too!** If you have leftover water in your glass, don't dump it down the drain - use it to water your household plants.
- Unplug it!** After you finish using an electronic, remember to unplug it if you do not need to charge the device. Electronics still pull energy even when left plugged in and turned off.

ENERGY AND WATER SAVING HOME AUDIT

Think you have what it takes to be an energy and water detective? Put your skills to the test with this home energy and water audit! Check each room in your house to see what actions you can do to save energy and water.

WHAT IS AN ENERGY AND WATER AUDIT?

An audit helps you keep track of energy and water in your home, school, or other buildings. To perform an audit, you look for things in your home that use energy and water, then calculate the energy and water usage. Audits can help you find things in your home that need to be changed or you need to interact with them differently to save energy and water.

GO THE EXTRA MILE! HOW MUCH WATER IS YOUR HOME REALLY USING?

- If your home gets a water bill from the City of Charlottesville each month, ask your parent or guardian to help you track how much water you've saved since last year.
- Don't have a water bill? **Check Out This Water Calculator:** <https://home-water-works.org/calculator>
- Look at the "Usage" to see how much water you've used in the month (1 pint: One cubic foot (Cu. Ft.) is equal to 7.48 gallons of water). Check out the "Monthly Usage" section in the bottom left to see how this month's usage compares to last month and even last year. Hopefully if you keep working on these water saving actions, you will see your monthly usage go down over time.
- You can do the same exercise with natural gas (should be on your water bill if you have natural gas in your house) and electricity (you will need to go to your electricity provider for the bill - most likely from Dominion).

Images 4 - 7: EWMP quarterly themed activity sheets for 2021/2022 Academic Year (Fall, Winter, Spring, Summer respectively). Full versions can be viewed on the [EWMP website \(LINK\)](#).

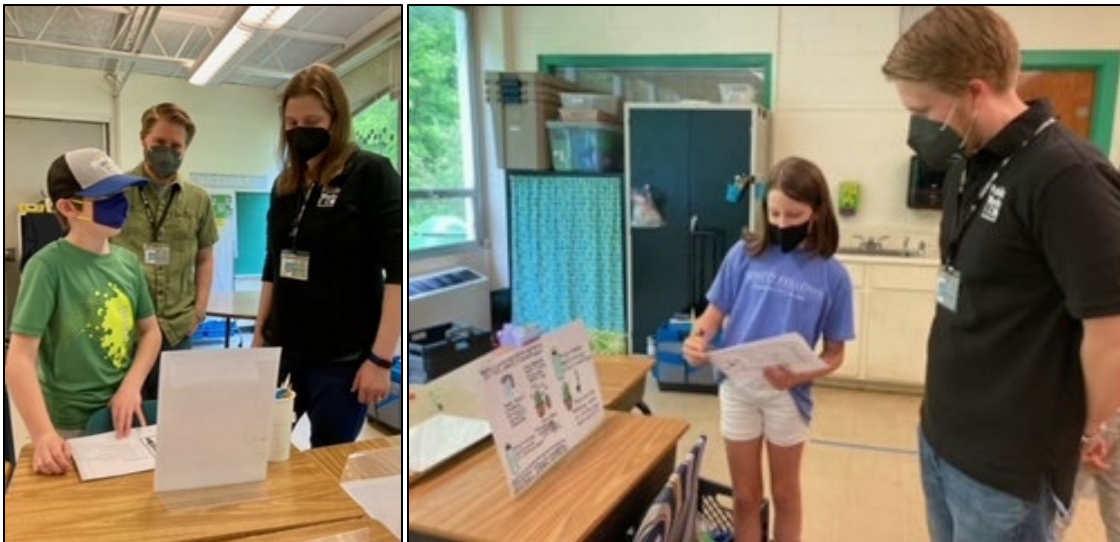
The EWMP continues to support education around behavior changes around saving energy and water to CCS staff and students. With students back in classrooms in FY2022, the EWMP sought to engage students with outreach materials including fun activities to do at their schools focused around turning their actions into savings. Since spring 2020, quarterly updates with each school's principals have been offered to discuss school's performance and upcoming educational initiatives. In addition, the EWMP

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 2021/2022 academic year for CCS was to “Turn Action into Savings. The program continued to build on what students learned last academic year and focused around saving energy and water at home and how to apply what they learned at school. For FY2022, activity sheets were used to engage students and have them work together in their classrooms (Images 4 - 7). These activity sheets were developed in coordination with and pushed out by CCS’s iSTEM staff to use in their lessons as well as to each school’s principal including announcements, activity sheet materials, and social media images to support additional outreach within their respective schools.

To ensure messaging and engagement reached students, education materials and messages were also supported through other outreach means including social media, newsletters, and websites ([CCS Energy and Water Conservation Website Link](#) and [City’s EWMP Education and Outreach Website Link](#)).

❖ Think Global, Act Local Classroom Activity



Images 8 - 9: EWMP Team at Greenbrier Elementary 4th grade class hearing about their final projects in their “Think Global, Act Local” lesson and listening to their marketing pitch on what energy and water saving behavior they thought were important.

The EWMP was excited to get into the classrooms this fiscal year and worked with a Greenbrier 4th grade teacher to provide support and engagement with her students around their “Think Global, Act Local” classroom project. These students reviewed the EWMP educational materials, reviewed the [CCS Performance Dashboard \(LINK\)](#), brainstormed their own important educational messages around saving energy and water at school, and came up with our own message and design. Students presented their energy and water saving tips and message to the EWMP and discussed how these behavior changes can have a big and important impact on their school’s energy and water usage (Images 8 - 9). This was a great experience for both the students and the EWMP Team, and even resulted in several classes turning off excessive decorative lighting in the classroom that day. The EWMP plans to incorporate some of their energy and water saving tips in the next school year’s outreach materials.

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

On Earth Day 2022, 370 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 (Image 10). 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; climate justice art project; a solar-powered night light; and a water leak detection activity (Image 11). 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 for the second year in a row. EWMP continued to work with Charlottesville City Schools on ways students can save energy and having the opportunity to provide a hands-on activity to further support the program's message was instrumental in getting students to implement change at school and at home.



Images 10 – 11: 10- Walker Upper Elementary teachers with Principal Hastings in front of the 370 Climate Action Kits. 11- Students from Walker Upper Elementary checking out the contents of the Climate Action Kits.

❖ Bottle Filling Water Conservation Signs

Many of the schools received bottle filling stations either through private funding or COVID-19 support funding. To help provide connection to the students around their drinking water and the importance of conserving water, educational posters were developed by the EWMP and shared with each school to request customized posters with their school logo and picture of their students using the bottle filler (Images 12 – 13). Currently, these posters are on display at two schools, Burnley Moran Elementary and Clark Elementary.



Images 12 - 13: Educational posters put up at bottle filling stations at Burnley Moran Elementary and Clark Elementary.

Community Climate Collaborative's Green Schools Network

The Community Climate Collaborative (C3) hosted regular virtual meetings with local school educators, administrators, and parents from Charlottesville and the surrounding area to discuss green school-wide initiatives. The EWMP attended these meetings and provided updates on their education and outreach efforts with CCS students and staff and shares the resources they have developed with other educational staff on the call.

Strategies Planned/FY2023 Outlook

WE@Work

The EWMP has been developing 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". It is a set of steps that help workplaces increase efficiency and change behaviors (Image 14). The EWMP 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 EWMP also developed an "At Home" version of WE@Work to engage



Image 14: WE@Work Logo for EWMP's workplace engagement program standing for Water and Energy at Work.

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remote staff until this program can be launched. The tentative launch date of this program is in the Winter of 2023.

Energy and Water Management Campaign at CCS

The EWMP continues to provide education and outreach to the schools through quarterly educational messaging and materials. The program hopes to include more hands-on opportunities and classroom visits to increase engagement with 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- 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, meaning 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.

FY2022 was still not a normal (i.e., pre-pandemic) year with a few City facilities still closed to the public and some staff continuing to work remotely; however, schools and recreational facilities opened back up and many of the buildings needed to be operated close to normal conditions to accommodate staff, students, and people using the facilities. In some instances, this caused buildings to use more energy as they had to heat a space with fewer people contributing their body heat. In addition, usage and costs were higher than FY2021 when building occupancy was low and many facilities were closed for a period of time. The EWMP continues to track the impacts of COVID-19 and to research how best to handle such a unique time 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 within a building group and to national standards. The EWMP identified 11 building groups which represent the various 70+ City facilities, and Appendix 2 references which specific facility falls under each building group (Table 2). 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 5).



Table 2: The City’s 11 building groups and important portfolio performance metrics. Specific buildings under each building group listed in Appendix 2. [Source for Regional Average EUI](#)

Building Group	Gross Floor Area (sq. ft.)	Site Energy Use Intensity (kBtu/sq.ft.)	Regional Average EUI	FY2022 Energy Change (compared to FY2021)	FY2022 Water Change (compared to FY2021)
Courthouses	59,886	52.7	101.2	1%	5%
Fire Stations	60,660	58.7	63.5	19%	-4%
Libraries	46,945	64.9	71.6	-1%	45%
Offices	243,550	45.4	52.9	-5%	-5%
Parks	--	--	--	21%	42%
Recreation & Sports	121,953	107.7	50.8	136%	63%
Schools	845,984	52.9	48.5	8%	27%
Street Lights & Traffic Signals	--	--	--	7.2%	--
Transit & Parking*	235,292	27	56.2	5%	-34%
Vehicle Charging Stations	--	--	--	9%	--
Warehouses & Fleet Mixed Use	88,908		--	-1%	-4%
Offices**	43,340	43.8	52.9		
Vehicle Repair***	45,568	59.3	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 FY2022 compared to the regional average for their representative building groups (Table 2). Although upgrades to more efficient equipment and building to green building standards have contributed to this performance, in cases where occupancy was still 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. Schools and Recreation & Sports building groups had largely a return to normal operations which caused the EUI to increase in FY2022.

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 6).

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Eight facilities reached the prerequisite score in FY2022 but have not yet been certified. As many facilities have only partially seen some re-occupancy in FY2022, 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 6) and will then evaluate pursuing ENERGY STAR certification for eligible facilities once confident of their accuracy.

Portfolio Performance

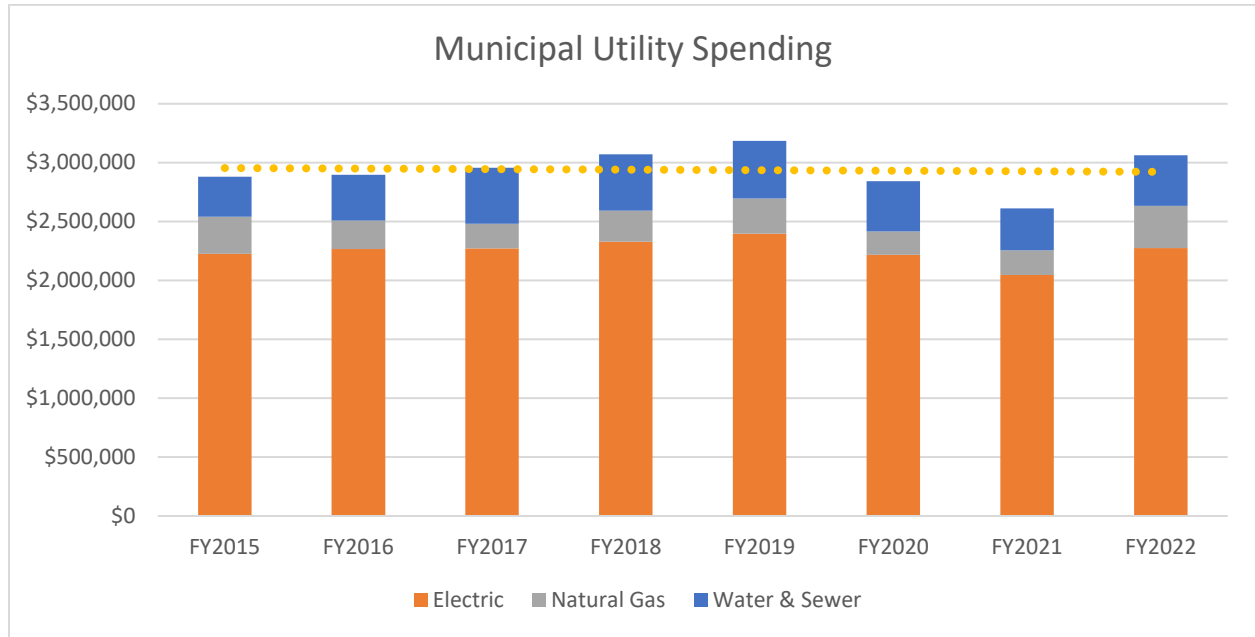


Figure 1: The City’s utility spending for the past 8 fiscal years for each commodity type across all City facilities. The yellow dotted line is the overall trend in spending over time across all 8 years.

Overall, the City (government and schools) spent over \$3.06 million for energy and water utilities in FY2022, which shows a rebound in usages similar to FY2019 (pre-pandemic costs) (Figure 1). Although costs were less than FY2019, they were still higher than FY2015. This increase in utility costs is

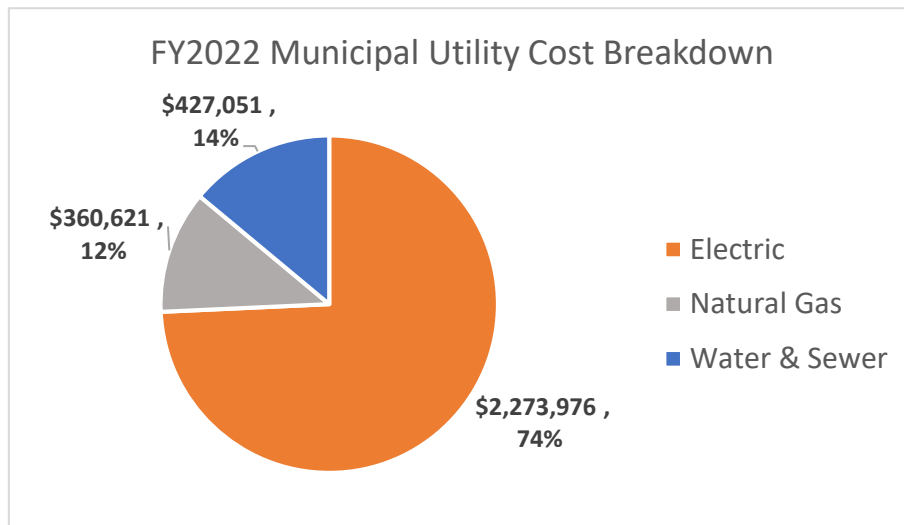


Figure 2: The City’s annual utility spending broken down by commodity type for FY2022 across all City facilities.

associated with increasing utility rates, facilities being open to the public and run at pre-pandemic levels, and building occupancy being close to pre-pandemic levels.

Electricity makes up the majority (74%) of the City's utility costs with water and sewer as the next largest at 14% of cost and natural gas contributing 12% of utility costs (Figure 2). Compared to the portfolio baseline FY2015, FY2022 saw a 6% increase in utility costs with a 2% increase in electricity cost, a 15% increase in natural gas cost, and a 26% increase in water cost. The large increases in costs were the result of a few large water leaks in FY2022 at several schools, as well as an increase in usage at a few water accounts, such as those connect to recreational water usage like splash pads.

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 FY2022 would ideally show a 14% reduction in utility usage. The City saw a decline in usage when compared to FY2015 (baseline year) - a 7% decline in electricity, a 3% decline in natural gas, and a 9% decline in water. This decline in usage overall is still not at our utility reduction goal of 14%; however, the declining trend is promising as facilities return to pre-pandemic usage and performance. The test of this decline will be next fiscal year as facilities are fully opened and most of staff return to working in offices again. 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

As stated above, electricity makes up the bulk of spending for utilities at 74% 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). Again, 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. However, in FY2022, occupancy increased in many facilities, including schools, and operations began to resemble pre-COVID levels. With this, electricity usage showed an increase of 10% in FY2022 compared to FY2021 but was still 7% below FY2015 levels. (Appendix 7.1).

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 streetlights, traffic signals, and vehicle charging stations.

When looking at the City's portfolio by building group, most groups (besides schools due to construction and renovation projects) have been steady or trended down since 2015 (Figure 3 & 4). As mentioned in previous reports, since School facilities make up nearly 50% of the electricity usage of the City's portfolio, they tend to drive the overall performance of the portfolio.

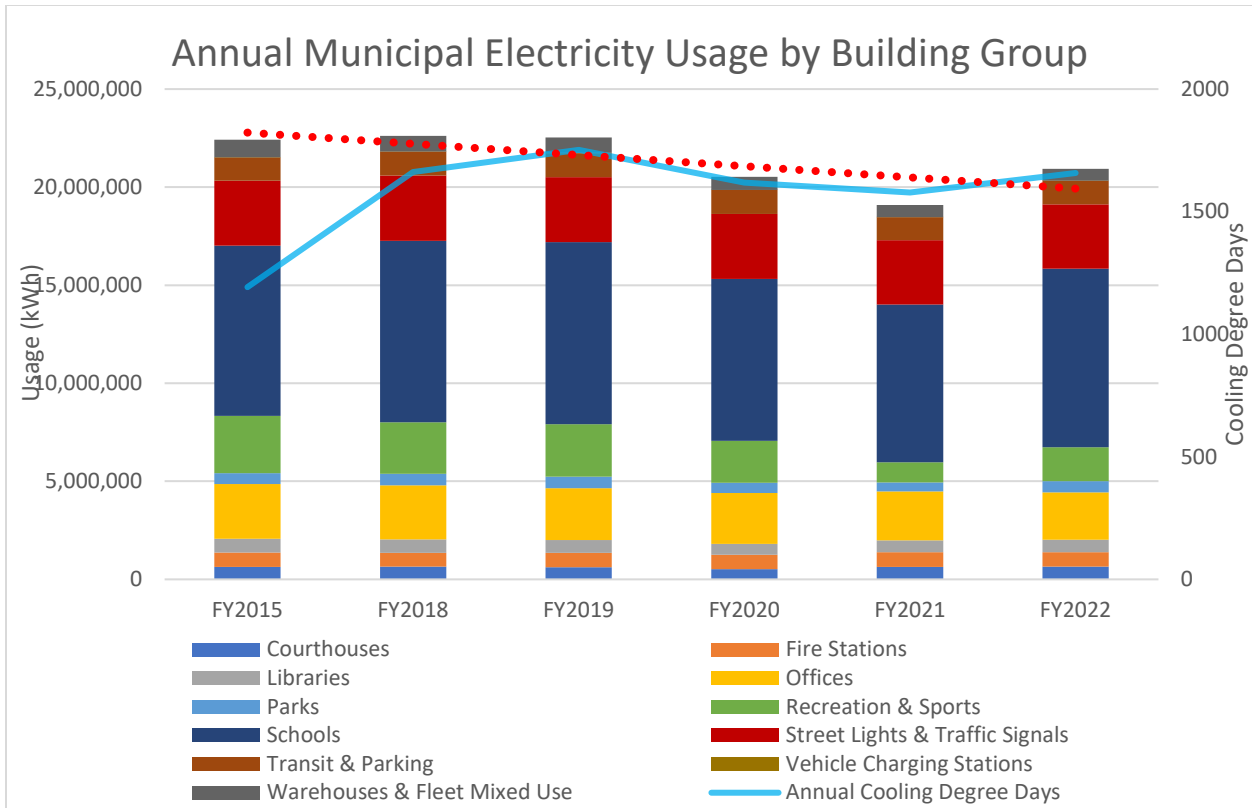


Figure 3: The City’s electricity usage for the past 5 fiscal years and FY2015 baseline year across all City facilities and partitioned out by building group. Annual Cooling Degree Days are included to show variance in weather conditions each year.

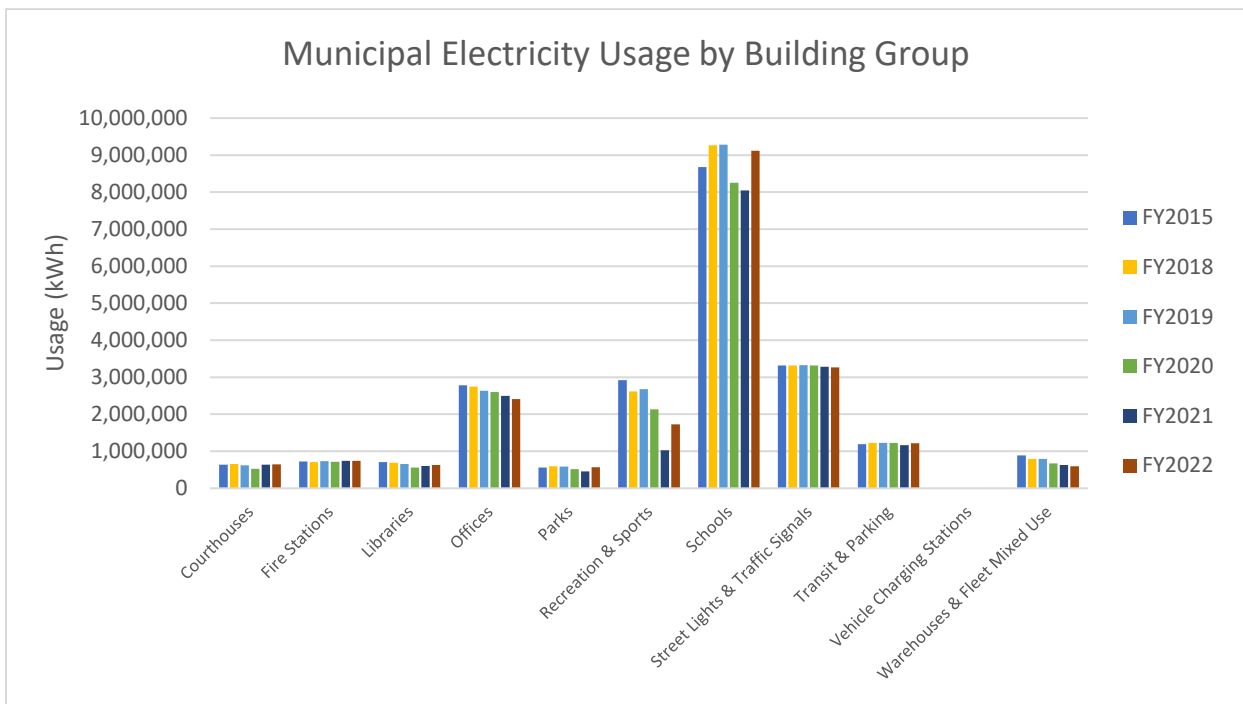


Figure 4: The City’s electricity usage for each building group over the past 5 fiscal years and FY2015 baseline year.

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After the significant drop in electricity seen in many building groups in FY2020 and FY2021, we’ve started to see a rebound in those that have experienced a return to normal occupancy, mainly in Schools and Recreation & Sports facilities. All schools were back to typical occupancy in FY2022 and Smith Aquatics Center, typically the largest energy user of the Recreation & Sports facilities, began to increase electricity usage as HVAC renovations were completed and the facility was reopened to the public. Parks also saw an increase as facilities began to open in FY2022. Office buildings continued to have lower electricity use in FY2022 as occupancy has not fully returned in all facilities and schedules continue to be refined to match shifting occupancy, reducing excess electricity usage.

The Street Lights & Traffic Signals building group has remained steady in the electricity usage but will begin to reduce as LEDs are installed to replace the high intensity discharge lighting. As the majority of street lights that are in the City’s portfolio are owned by Dominion Energy, the EWMP is currently working with Dominion to develop a plan for upgrading street lights.

Natural Gas

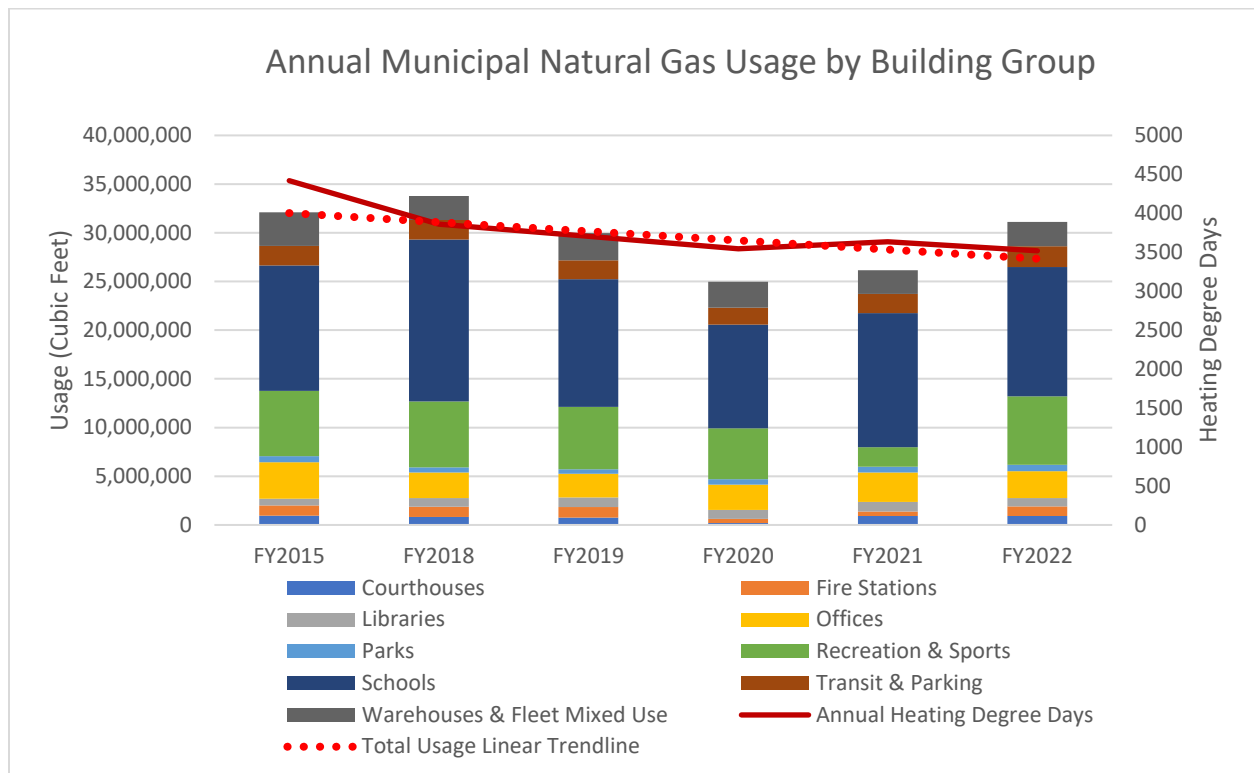


Figure 5: The City’s natural gas usage for the past 5 fiscal years and FY2015 baseline year across all City facilities and partitioned out by building group. Annual Heating Degree Days are included to show variance in weather conditions each year.

In FY2022, natural gas represented approximately 12% of utility spending in the City’s building portfolio. The portfolio saw a 19% increase in natural gas use compared to FY2021 - following the same trend as electricity - but still a 3% reduction from the FY2015 baseline. 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 some schools, it is also used by kitchen appliances.

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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, or 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). In FY2022, however, the largest increase in natural gas compared to FY2021 was in the Recreation & Sports building group. Crow Pool returned to normal operations and Smith Aquatics Center saw an increase in natural gas use during the HVAC renovations and then opened for public use. Within the Parks building group, Washington Park Pool facility saw an increase because of increased use in FY2022. The Fire Stations building group experienced a 121% increase in natural gas (Appendix 7.2) because Central Fire Station returned to normal natural gas levels from the major decrease seen in FY2020 and FY2021. The Schools building group did see a 3% reduction in natural gas compared to FY2021 (3% increase from FY2015) but the large increase in the other building groups drove the portfolio trend.

In FY2021 there was limited staff routinely occupying spaces throughout buildings, but the HVAC systems continued to supply conditioned air. During the winter of FY2021, buildings that previously had more heat generated 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. In FY2022, however, the Office building group had an increase in occupancy, which due to more heat from people and equipment running and less wasted space heating, likely contributed to the 9% reduction in natural gas (Appendix 7.2) compared to FY2021. The Facilities Maintenance team has made it a standard practice to perform periodic reviews of HVAC systems during the heating season to adjust schedules and equipment settings to reduce unnecessary heating.

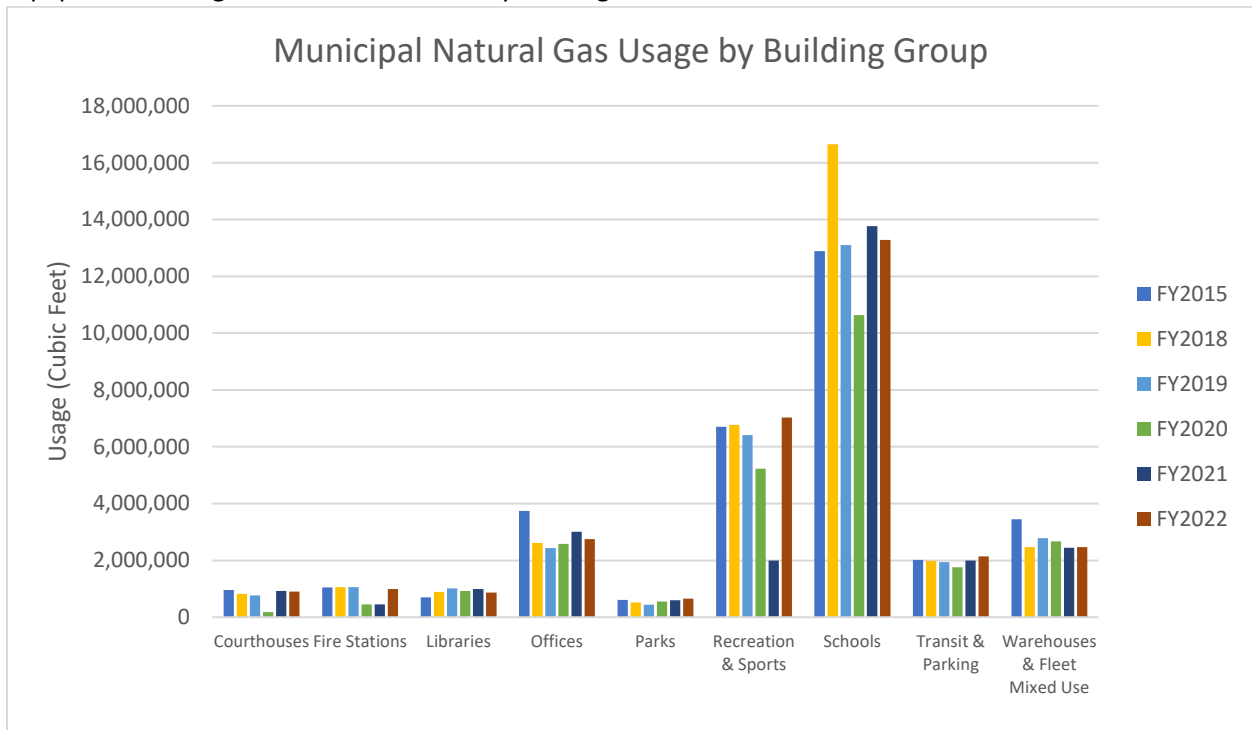


Figure 6: The City’s natural gas usage for each building group over the past 5 fiscal years and FY2015 baseline year.

Water and Sewer

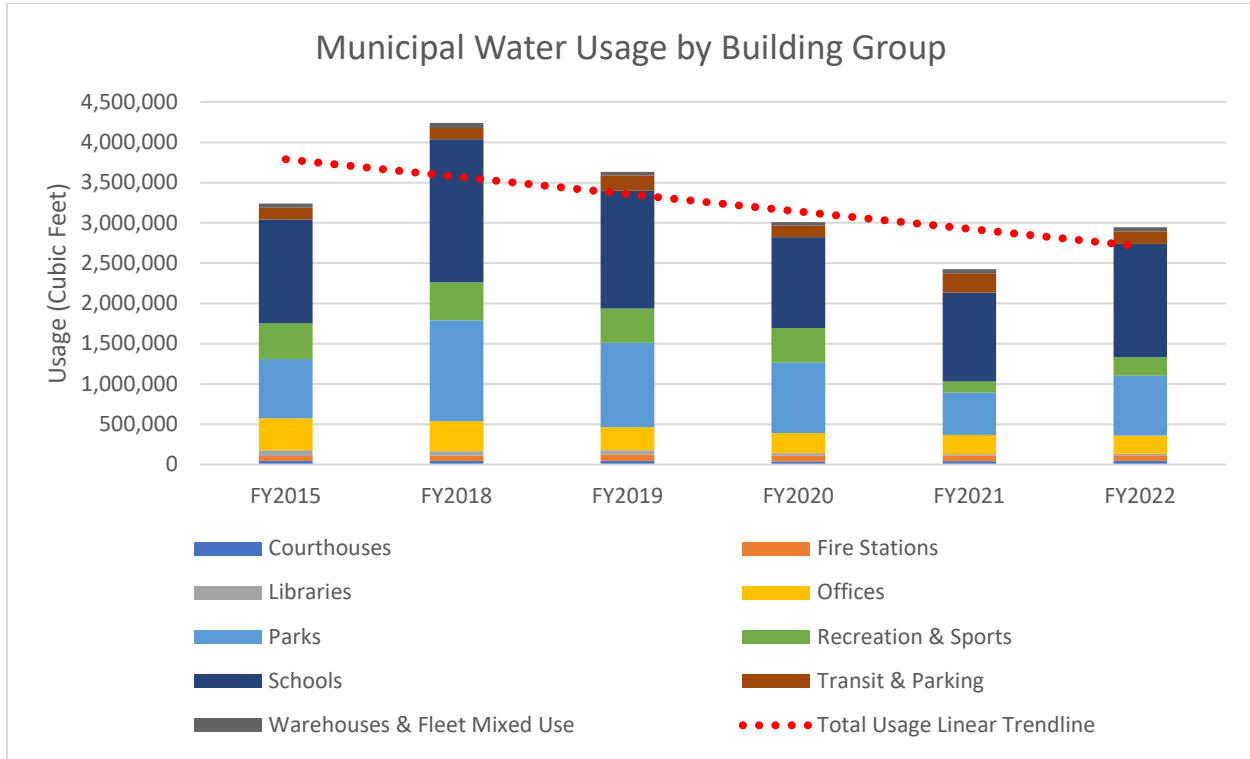


Figure 7: The City’s water usage for the past 5 fiscal years and FY2015 baseline year across all City facilities and partitioned out by building group.

In FY2022, 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 five years with a declining trend in usage over time, except in FY2021 which was significantly impacted by COVID19 (Figure 7). Water expenditures have been increasing overtime since the FY2015 baseline year (26%) (Figure 1, Appendix 7.3). This increase in costs is primarily driven by changes in water rates and fees as well as the addition of a few water accounts. When comparing FY2015 (baseline year) water usage to FY2022 usage, there is a 9% decline. This 9% decline in water usage falls short of the annual 2% reduction goal, which would be a total 14% decline from FY2015 to FY2022. There have been several building groups showing little to no change in water usage compared to FY2015 (e.g. Courthouses, Fire Stations, Parks, Transit & Parking, Warehouses & Fleet Mixed Use). Schools have shown the largest increase since FY2015 of 9%.

FY2022 was still an abnormal year in terms of water usage. Some City buildings were at or near full building occupancy and some were still seeing partial occupancy as COVID19 continued to impact working habits and City buildings remained closed to the public. In addition, with some buildings returning to full or partial occupancy, especially Schools and Parks and Recreational facilities, many buildings saw an increase in water fixture leaks ranging from water line leaks to the very common running toilet (Figure 8). Since Schools and Parks facilities make up the majority of the City’s water usage (48% and 25% of total usage respectively), the increase in water leaks at these facilities had a large impact on the City’s overall water usage for FY2022.

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When comparing FY2021 to FY2022 water usage, we see overall increases across nearly all building groups as facilities saw increases in usage and building occupancy (Figure 8, Appendix 7.3). The Transit and Parking group was the exception, with a 34% decline due to a large water leak at the Downtown Transit Station that impacted FY2021 consumption. Recreation and Sports facilities saw the largest increase in usage compared to FY2021 primarily driven by Key Recreation Center and Onesty Pool usage returning to a more normal operation (238% and 259% increase respectively). However, when comparing Recreation and Sports facilities usage to FY2015, we see a 49% decline in water usage reflecting that Smith Aquatic Center was being renovated for much of FY2022 and having limited occupancy, and Onesty Pool’s schedule still being reduced during the summer months to a typical summer schedule. Schools also had an increased water usage when comparing to FY2021 and FY2015 (27% and 9% respectively) primarily due to several water leaks including a cooling tower overflow at Clark Elementary in January 2022, water line leak at Charlottesville High School in the fall and spring, a running toilet at Venable Annex for several months in the late summer/early fall, a water line leak at Jackson-Via in February, and numerous water fixture issues that were running or leaking across all schools.

Although facilities saw an overall increase in water usage when compared to FY2021, the overall decline in water usage compared to the FY2015 baseline year reflects progress in efforts to reducing water usage across facilities. Hopefully, this trend continues as City facilities continue to return to pre-pandemic uses.

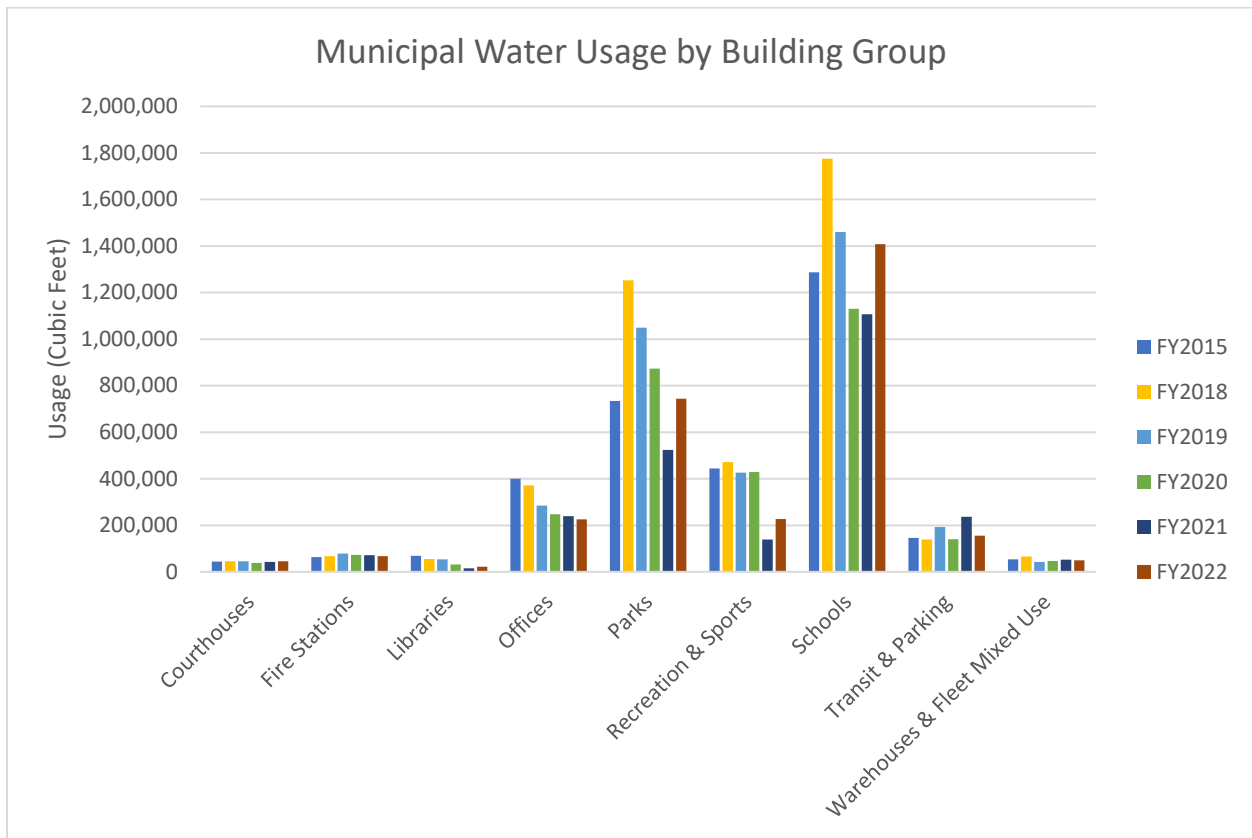


Figure 8: The City’s water usage for each building group over the past 5 fiscal years and FY2015 baseline year.

Greenhouse Gas Emissions

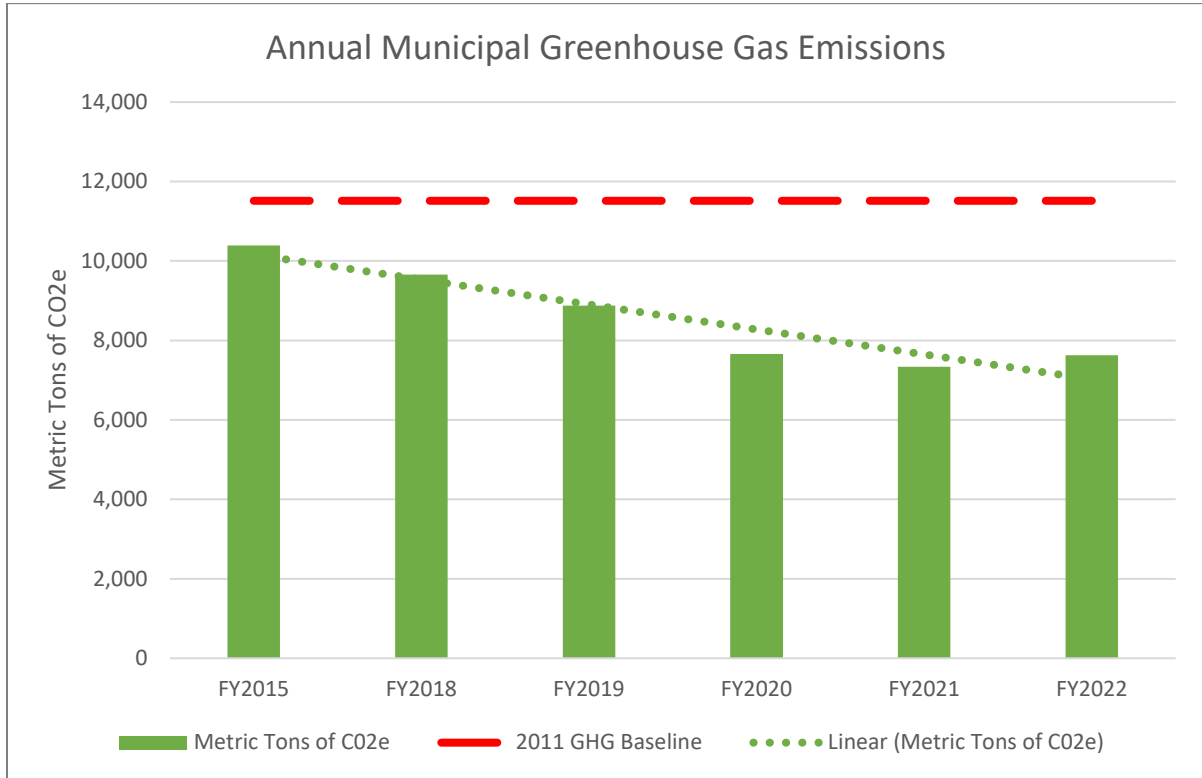


Figure 9: Greenhouse gas emissions for the past 5 fiscal years and FY2015 baseline year across all City and school facilities.

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 33.8% in total by FY2022) in greenhouse gas emissions (Figure 9). This reduction is in part due to the electric grid becoming cleaner or 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. In FY2022, we can begin

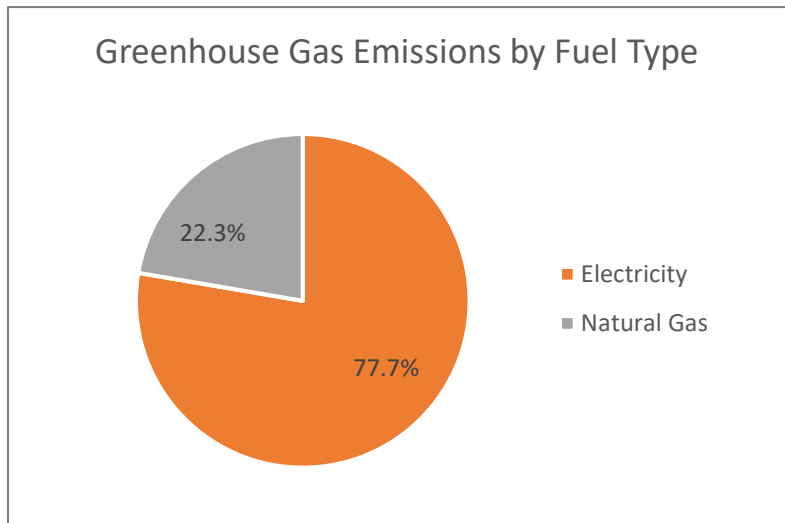


Figure 10: The City's FY2022 Greenhouse gas emissions by fuel type (percentage).

to see a rise in greenhouse gas emissions as buildings have become more occupied and are returning to normal operations.

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, 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 continued use will produce greenhouse gas emissions for the foreseeable future. The [City's Climate Action Plan \(LINK\)](#) presents strategies and key actions to reduce municipal greenhouse gas emissions by switching to lower emissions fuel sources and by reducing energy use through efficiency and conservation measures.

❖ Solar

As of FY2022, the City's solar PV systems (Table 3) 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 15), 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 EWMP.

Table 3: 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 15: Solar PV system on the roof of Smith Aquatics Center.

Solar has been identified in current planning discussions as the primary renewable energy 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 conditions and well as available 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. Aligning the solar potential of roofs and roof replacement schedules is critical to ensuring that any onsite systems are timed appropriately with roof replacements.

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. The City has achieved LEED certification for seven buildings since 2008 (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 - <i>Renovation</i>	2020	Gold



FY2023 Outlook

COVID-19's impact was still seen in FY2022 and even into FY2023 as the City officially opened its facilities to the public in October 2022. As City facilities return to normal operation, utility usage and costs are anticipated to continue to increase (higher than FY2019 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.

In FY2023, 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 EPC, 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 and emission reductions 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 also reducing emissions.

The EWMP is looking forward to continuing its education and outreach of City staff and students and hopefully incorporate more in-person connection and engagement. As we enter our new normal in FY2023 with the way buildings will need to be operated to reduce the spread of diseases, intentional utility management will become essential to ensuring reductions in utility usage. 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.

Calendar Year (CY): Unit of time looking at measurements made from January 1st through December 31st 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°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.

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 Performance Contract (EPC): 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 1st through June 30th 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 mathematics 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: Previous Annual Energy and Water Performance Reports

City of Charlottesville Reports

FY2021 Energy and Water Performance Report

- [City of Charlottesville Fiscal Year 2021 Energy and Water Performance Executive Summary \(PDF\)](#)
- [City of Charlottesville Fiscal Year 2021 Energy and Water Performance Report \(PDF\)](#)
- [EnergyCAP City of Charlottesville Fiscal Year 2021 Energy and Water Performance Dashboard \(LINK\)](#)

FY2020 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 \(LINK\)](#)

Charlottesville City School Reports

2020 Charlottesville City Schools Energy and Water Performance Report

- [Charlottesville City Schools Annual Water and Energy 2020 Performance Report and Executive Summary \(PDF\)](#)
- [EnergyCAP Charlottesville City Schools Fiscal Year 2020 Energy and Water Performance Dashboard \(LINK\)](#)

2019 Charlottesville City Schools Energy and Water Performance Report

- [Charlottesville City Schools Annual Water and Energy 2019 Performance Report and Executive Summary \(PDF\)](#)
- [EnergyCAP Charlottesville City Schools Fiscal Year 2019 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

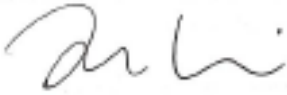
- Multiple Locations

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.

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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 \(PDF\)](#)

City FY2022 Annual Energy and Water Performance Report

Appendix 5: EnergyCAP Dashboard info & Link

[EnergyCAP FY2022 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 EWMP 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 specifically 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 FY2022; however, a few are continually updated with data over time but still include FY2022 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.



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Appendix 6: City Benchmarked Facilities and ENERGY STAR Scores

Facilities	ENERGY STAR Score*		
	FY2015	FY2021	FY2022
Buford Middle School	43	59	47
Burnley-Moran Elementary School <i>(ES Cert. 2009)</i>	33	68	66
Bypass Firehouse	202.1 kBtu/sf	197.3 kBtu/sf	165.3 kBtu/sf
Central Fire House	157.8 kBtu/sf	114.6 kBtu/sf	143.8 kBtu/sf
Central Library	192.9 kBtu/sf	183.2 kBtu/sf	192.4 kBtu/sf
Charlottesville High School <i>(ES Cert. 2009)</i>	71	69	58
Circuit Court	39	57	58
City Hall Annex	39	38	50
City Hall Complex <i>(ES Cert. 2009)</i>	81	91	89
Clark Elementary School <i>(ES Cert. 2009)</i>	37	55	41
Community Attention Main Office (909 E Market St.)	39	38	45
CAFF Office (414 4th St.)	84	87	92
Crow Pool/Center	342.6 kBtu/sf	183.6 kBtu/sf	418.6 kBtu/sf
Downtown Transit Station	54	68	67
Facilities Maintenance	99	96	98
Fontaine Fire Station	121.2 kBtu/sf	125.1 kBtu/sf	127.8 kBtu/sf
Gordon Avenue Library	136.3 kBtu/sf	101.4 kBtu/sf	99.2 kBtu/sf
Greenbrier Elementary School <i>(ES Cert. 2009)</i>	51	67	60
DHS Administration (907 E Jefferson St.)	40	75	72
Jackson-Via Elementary School <i>(ES Cert. 2009)</i>	65	67	57
Jessup House	*	91	99
Johnson Elementary School <i>(ES Cert. 2009)</i>	71	78	76
Juvenile & Domestic Relations Court	46	51	49
Key Recreation Center	99.0 kBtu/sf	56.4 kBtu/sf	79.5 kBtu/sf
Lugo-McGinness Academy	82	96	85
Market St Parking Garage	63.7 kBtu/sf	63.3 kBtu/sf	66.1 kBtu/sf
Onesty Pool	239.4 kBtu/sf	69.5 kBtu/sf	117.8 kBtu/sf
Preston-Morris Building	70	82	73
Public Works Administration	73	86	88
Pupil Transportation	99	100	100
Smith Aquatic Center	656.3 kBtu/sf	77.7 kBtu/sf	313 kBtu/sf
Tonsler Park	107 kBtu/sf	164.9 kBtu/sf	242.2 kBtu/sf
Transit Operation Center	149.5 kBtu/sf	127.5 kBtu/sf	116.4 kBtu/sf
Venable Elementary School	52	63	61
Venable School Annex	1	56	10
Walker Upper Elementary School	40	30	29
Wheeler Building	41	55	44

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

Appendix 7: Detailed Utility Usage and Costs for FY2021 and FY2022

Appendix 7.1: City of Charlottesville’s electric usage and costs for each building group in FY2021 and FY2022 with percent comparison.

Building Group	Electricity (kWh)			Electricity Cost		
	FY2021	FY2022	% Change	FY2021	FY2022	% Change
Courthouses	640,141	650,420	2%	\$60,595	\$62,863	4%
Fire Stations	744,474	742,518	0%	\$59,779	\$62,177	4%
Libraries	604,718	631,672	4%	\$54,176	\$60,823	12%
Offices	2,499,116	2,410,791	-4%	\$208,635	\$207,091	-1%
Parks	453,870	569,130	25%	\$48,122	\$58,624	22%
Recreation & Sports	1,028,161	1,729,393	68%	\$114,321	\$163,492	43%
Schools	8,042,006	9,116,873	13%	\$774,897	\$912,998	18%
Street Lights & Traffic Signals	3,280,737	3,265,358	0%	\$570,420	\$579,598	2%
Transit & Parking	1,168,477	1,213,491	4%	\$97,401	\$108,379	11%
Vehicle Charging Stations	3,219	3,509	9%	\$486	\$534	10%
Warehouses & Fleet Mixed Use	629,072	601,743	-5%	\$57,212	\$57,398	0%
Total	19,093,990	20,934,896	10%	\$2,046,044	\$2,273,976	11%

*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.

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Appendix 7.2: City of Charlottesville’s natural gas usage and costs for each building group in FY2021 and FY2022 with percent comparison.

Building Group	Natural Gas (cubic feet)			Natural Gas Cost		
	FY2021	FY2022	% Change	FY2021	FY2022	% Change
Courthouses	921,300	907,200	-2%	\$8,292	\$11,752	42%
Fire Stations	452,103	997,713	121%	\$4,099	\$12,141	196%
Libraries	993,816	867,639	-13%	\$8,166	\$10,647	30%
Offices	3,010,337	2,748,047	-9%	\$24,241	\$32,898	36%
Parks	599,445	659,650	10%	\$5,720	\$8,693	52%
Recreation & Sports	1,995,093	7,024,550	252%	\$16,295	\$79,660	389%
Schools	13,764,411	13,285,104	-3%	\$105,653	\$149,397	41%
Street Lights & Traffic Signals	-	-	-	-	-	-
Transit & Parking	1,989,500	2,144,900	8%	\$15,844	\$25,349	60%
Vehicle Charging Stations	-	-	-	-	-	-
Warehouses & Fleet Mixed Use	2,441,511	2,472,407	1%	\$20,582	\$30,086	46%
Total	26,167,515	31,107,210	19%	\$208,893	\$360,621	73%

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Appendix 7.3: City of Charlottesville’s water usage and costs (water and sewer) for each building group in FY2021 and FY2022 with percent comparison.

Building Group	Water Use (cubic feet)			Water & Sewer Cost		
	FY2021	FY2022	% Change	FY2021	FY2022	% Change
Courthouses	42,508	44,741	5%	\$7,508	\$8,278	10%
Fire Stations	71,050	67,937	-4%	\$12,919	\$13,413	4%
Libraries	15,280	22,163	45%	\$3,163	\$4,338	37%
Offices	238,624	226,034	-5%	\$38,384	\$38,225	0%
Parks	523,656	743,805	42%	\$75,096	\$103,213	37%
Recreation & Sports	138,970	226,830	63%	\$18,335	\$28,733	57%
Schools	1,106,369	1,408,165	27%	\$159,158	\$199,102	25%
Street Lights & Traffic Signals	-	-	-	-	-	-
Transit & Parking	237,047	155,603	-34%	\$33,521	\$23,949	-29%
Vehicle Charging Stations	-	-	-	-	-	-
Warehouses & Fleet Mixed Use	51,917	49,920	-4%	\$7,905	\$7,799	-1%
Total	2,425,421	2,945,200	21%	\$355,989	\$427,051	20%