

# CHARLOTTE

## ENERGY PERFORMANCE BENCHMARKING REPORT FOR MUNICIPAL BUILDINGS

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2020-2021 Energy Usage



# Acknowledgements

The City of Charlotte's inaugural Energy Performance Benchmarking Report for Municipal Buildings was prepared by the city's **Office of Sustainability and Resilience** in the Department of General Services.

The authors would like to acknowledge Heather Bolick of the Office of Resilience and Sustainability, Alicia Barone of the city's Aviation Department and Ashley Gladney with the Charlotte Regional Visitors Authority, for supporting the collection and interpretation of operational data associated with the buildings under their management. The authors would also like to thank Beverlee Sanders with Charlotte Communication & Marketing for her help in the preparation of this report.


Finally, the authors would like to thank support staff members from **Bloomberg Philanthropies American Cities Climate Challenge** and the Natural Resources Defense Council for their support in crafting Charlotte's latest Sustainable Facilities Policy, implementing the benchmarking component of this policy and developing the city's first public-facing benchmarking report.









An aerial photograph of Charlotte, North Carolina, showing a multi-lane highway with traffic in the foreground and the city skyline in the background. The skyline includes several prominent skyscrapers, with the Bank of America Corporate Center being the tallest. The highway has multiple lanes in both directions, with cars and trucks visible. There are some construction barriers and orange traffic cones on the left side of the highway. The surrounding area has some trees with autumn foliage and a bridge in the distance.

***“ Charlotte is proud to join the ranks of other leading cities in measuring our building performance against national standards and transparently sharing our year-over-year progress with the broader Charlotte community.***

*- Mayor Vi Lyles*

*The City of Charlotte has a fast-growing population of nearly 900,000 residents and is the 15th largest city in the United States. The greater Charlotte region is home to more than 2.5 million residents.*





Mayor Vi Lyles



City Manager Marcus D. Jones

## MESSAGE *from the* **MAYOR and CITY MANAGER**

*We are a welcoming, diverse and resilient city and are committed to becoming a community where every person can thrive and prosper. To fulfill that commitment, we must acknowledge the growing risks climate change has on the health, vibrancy and viability of our city, and we must take action to reduce our carbon emissions that are contributing to climate change.*

Charlotte has joined thousands of cities and regions in a commitment to accelerate ambitious and measurable climate and energy initiatives that will lead to an inclusive, equitable, low-emission and climate-resilient future. In June 2018, the Charlotte City Council voted unanimously to support the **Sustainable and Resilient Charlotte by 2050** resolution, which states that Charlotte will strive to source 100% of the city's energy use for its buildings and fleet from zero-carbon sources, become a low-carbon city by 2050 and reduce citywide greenhouse gas emissions to below 2 tons carbon dioxide equivalent per person annually. The City Council also unanimously adopted the city's **Strategic Energy Action Plan (SEAP)** in December of 2018, which guides Charlotte's transition to a low-carbon future.

Achieving a low-carbon future for Charlotte requires a transformational change in the way we consume and generate energy. The city has already made significant progress toward our 2030 and 2050 carbon reduction goals with unprecedented levels of investments in solar, electric vehicles and electric vehicle infrastructure. Early successes include our **35-megawatt utility scale solar project**, the beginning of our **conversion to battery electric buses** and the launch of the **Renewable Energy and Efficiency Workforce training program**. In 2021, Charlotte City Council also unanimously approved revisions to the city's Sustainable Facilities Policy, including changes that will increase the use of renewable energy and improve energy efficiency in municipal buildings.

One exciting addition to that policy is energy performance benchmarking and disclosure for municipal buildings. This requirement is considered a best practice among local government clean energy practices, and Charlotte is proud to join the ranks of other leading cities in measuring our building performance against national standards and transparently sharing our year-over-year progress with the broader Charlotte community.

We are pleased to release our first energy performance benchmarking report for municipal buildings. Annual benchmarking will help us focus our efforts and capital investments to efficiently and cost-effectively achieve our low-carbon goals. We encourage commercial, industrial and multifamily residential building owners to follow our lead so that we can collectively achieve the carbon reductions needed to mitigate the impacts of climate change. We understand the enormity of the challenge before Charlotte and the world, and together we can meet this challenge and succeed!



CHARLOTTE-MECKLENBURG  
**GOVERNMENT CENTER**  
CENTRO DE GOBIERNO

600

600

EAST 4TH STREET



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# EXECUTIVE SUMMARY

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*In December of 2018, the Charlotte City Council unanimously adopted the **Strategic Energy Action Plan (SEAP)** to determine how Charlotte would reach the goals established in the Sustainable and Resilient Charlotte by 2050 resolution. This resolution strives to have city fleet and facilities fueled by 100% zero-carbon sources by 2030. It also sets a community-wide goal for Charlotte to become a low-carbon city by 2050 by reducing greenhouse gas emissions to below 2 tons of carbon dioxide equivalent per person annually.*

One strategy to achieve these goals includes reducing energy consumption in existing buildings. At present, the City of Charlotte owns and/or operates more than 20 million square feet of building space. Collectively, the city spends approximately \$37 million on energy annually and building energy usage accounts for 56% of municipal carbon emissions. Although historical efforts to reduce energy usage in existing buildings have led to year-over-year reductions in energy costs and carbon emissions, additional improvements in building energy efficiency remain an important element in achieving zero-carbon buildings by 2030.

In early 2021, the City Council approved revisions to the city's Sustainable Facilities Policy, which directs city departments to design, construct and operate city buildings in alignment with stated 2030 SEAP goals. Features of the revised Sustainable Facilities Policy include requiring rooftop solar for new buildings and roof replacement projects, as well as electric vehicle (EV) parking spaces to facilitate anticipated fleet EV growth. Collectively, the changes in the new Sustainable Facilities Policy will enable additional reductions in the city's carbon footprint.

This report focuses on another important feature of the revised Sustainable Facilities Policy, energy performance benchmarking for city buildings. Energy performance benchmarking refers to measuring a building's energy use and comparing it to the energy use of similar buildings, its own historical usage or a reference performance level.<sup>1</sup> The city has benchmarked a subset of its buildings for several years and has also taken advantage of the results to focus capital investments on buildings in most need of energy performance improvements. The revised Sustainable Facilities Policy institutionalizes benchmarking across all city operations for all qualifying municipal buildings. The policy also requires sharing those results publicly to demonstrate performance improvements over time. The new pieces of the Sustainable Facilities Policy will enable all city buildings to improve their energy performance over time and benchmarking will help city staff identify the buildings that need further attention to raise their energy performance levels. This and subsequent reports will support prioritizing and planning for energy efficiency and renewable energy investments across the city's portfolio of municipal buildings.

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<sup>1</sup> <https://bit.ly/BenchmarkingToolkitUSEPA>



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The Environmental Protection Agency's (EPA) ENERGY STAR Portfolio Manager tool is the standard tool most United States building operators use for benchmarking. To date, 40% of commercial building space in the U.S., including 35% of Fortune 500 company building operators are already benchmarking in Portfolio Manager.<sup>2</sup> A recent study by the EPA found that buildings benchmarked on a consistent basis achieved an average annual energy savings of 2.4%.<sup>3</sup> Recent studies also show strong correlations between lower energy consumption, associated greenhouse gas reductions and improved public health.<sup>4</sup>

Of the municipal buildings benchmarked in this report, 40% are performing at or above the national energy performance median for comparable building types and 60% are performing below their respective national medians. Additional takeaways from the city's first comprehensive benchmarking effort include:

- **75% of the city's office buildings** are performing better than the national energy performance median.
- **75% of the city's fire stations** are performing below the national energy performance median. Additional investigative work into these performance outcomes will yield solutions that could be scaled broadly to enable meaningful reductions in energy usage and increased cost savings.
- **Facilities that operate 24/7** represent an important opportunity to scale energy efficiency solutions across the building portfolio and make significant reductions in energy usage and associated costs.
- **The city spent \$5.5 million in energy** to operate buildings within the portfolio benchmarked in this report during the 12-month performance period. If these buildings achieve the average annual energy savings of 2.4% for buildings that consistently benchmark, the city would save \$132,000 in annual energy costs and reduce municipal building carbon emissions by more than 1,000 metric tons annually.

## COVID-19 Impact

The performance period for the buildings included in this report covers the latter months of 2020 and the early months of 2021, which also coincides with a period when the city was operating under precautions due to the COVID-19 pandemic. Operational changes brought on by COVID-19 varied for different building types and impacted benchmarking scores. This will be important context to consider for next year's benchmarking report in order to differentiate true performance changes from a return to normal operations.

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<sup>2</sup> <https://bit.ly/EPAToolMeasureTrackEnergy>

<sup>3</sup> <https://bit.ly/OverviewStateLocalDecision>

<sup>4</sup> <https://bit.ly/BuildingPerformancePolicy>



# INTRODUCTION

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## Background

*In June 2018, the Sustainable and Resilient Charlotte by 2050 resolution was unanimously passed by the City Council. This resolution set municipal and communitywide greenhouse gas emissions reduction goals for the City of Charlotte. Specifically, it strives to have the city's fleet and facilities fueled by 100% zero-carbon sources by 2030. It also sets a communitywide goal for Charlotte to become a low-carbon city by 2050, reducing greenhouse gas emissions to less than 2 tons of carbon dioxide equivalent per person annually.*

In December of 2018, the City Council unanimously adopted the Strategic Energy Action Plan (SEAP) to determine how Charlotte would reach its mid- and long-term climate goals. The SEAP is a comprehensive framework containing internal and external actions with steps to reach the goals set by the resolution. It focuses on transportation, buildings, energy generation and workforce development with a foundation of equity and innovation.

In early 2021, the Charlotte City Council approved revisions to the Sustainable Facilities Policy, which directs city departments to design, construct and operate city buildings in a manner aligned with 2030 SEAP goals. A major focus of this policy is energy usage in existing buildings, and it includes a requirement to benchmark and disclose building energy performance.

## What Is Benchmarking?

*Benchmarking is a method to determine whether a building is using more or less energy than comparable buildings with similar use characteristics. This method also allows organizations to check their own yearly energy reduction progress.*

Basic benchmarking can be done by taking a building's annual energy usage and dividing it by the building's total square footage. This number is referred to as energy use intensity (EUI), and it is compared to the EUI of reference buildings to determine the relative energy performance and gauge how efficiently the building is consuming energy. A minimum of 12 months of energy usage is needed to benchmark because it is important to account for seasonal variations in energy usage. EUI is the most common metric for benchmarking and its unit of measurement is annual energy use per square foot (kBtu/sq.ft./yr.). The smaller the EUI value is, the more efficient the building is performing.



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More sophisticated benchmarking can be done by factoring in other operational factors such as operating hours, building age, number of employees, climate and more. The Environmental Protection Agency's (EPA) ENERGY STAR Portfolio Manager is the standard tool most building operators use for benchmarking. For select qualifying building types, Portfolio Manager converts EUI values into a score on a 1-100 scale, with a score of 50 representing median energy performance and 100 representing the best performance. The greater the Portfolio Manager score is, the more efficient the building is performing.<sup>5</sup> Forty percent of commercial building space in the U.S., including 35% of Fortune 500 company building space, are already benchmarking in Portfolio Manager.<sup>6</sup> Qualifying buildings whose energy performance is in the 25<sup>th</sup> percentile or higher can earn the EPA's ENERGY STAR building designation.

## Why Are We Benchmarking?

Benchmarking can offer several benefits for building owners, operators, occupants and surrounding communities. A recent study by the EPA found that buildings benchmarked on a consistent basis achieved an average annual energy savings of 2.4%.<sup>7</sup> In addition, studies have established strong correlations between reduced energy consumption, associated greenhouse gas reductions and improved public health.<sup>8</sup> Finally, reductions in energy usage allows the city to get closer to reaching its low-carbon SEAP goals.

Benchmarking data allow building owners and operators to assess the relative energy performance of their buildings and prioritize investment opportunities to cost-effectively reduce energy consumption. When benchmarking is coupled with public disclosure of energy performance, building owners and operators are even more compelled to reduce energy waste and avoid excessive spending on energy. This is because "disclosure of energy performance drives greater transparency, awareness, and consideration of building efficiency in the marketplace."<sup>9</sup>

***A recent study by the EPA found that buildings benchmarked on a consistent basis achieved an average annual energy savings of 2.4%.***

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<sup>5</sup> <https://bit.ly/PropertyTypesEligibleEnergyStarScore>

<sup>6</sup> <https://bit.ly/OverviewEPAPortfolioManagerTool>

<sup>7</sup> <https://bit.ly/OverviewStateLocalDecision>

<sup>8</sup> <https://bit.ly/BuildingPerformancePolicy>

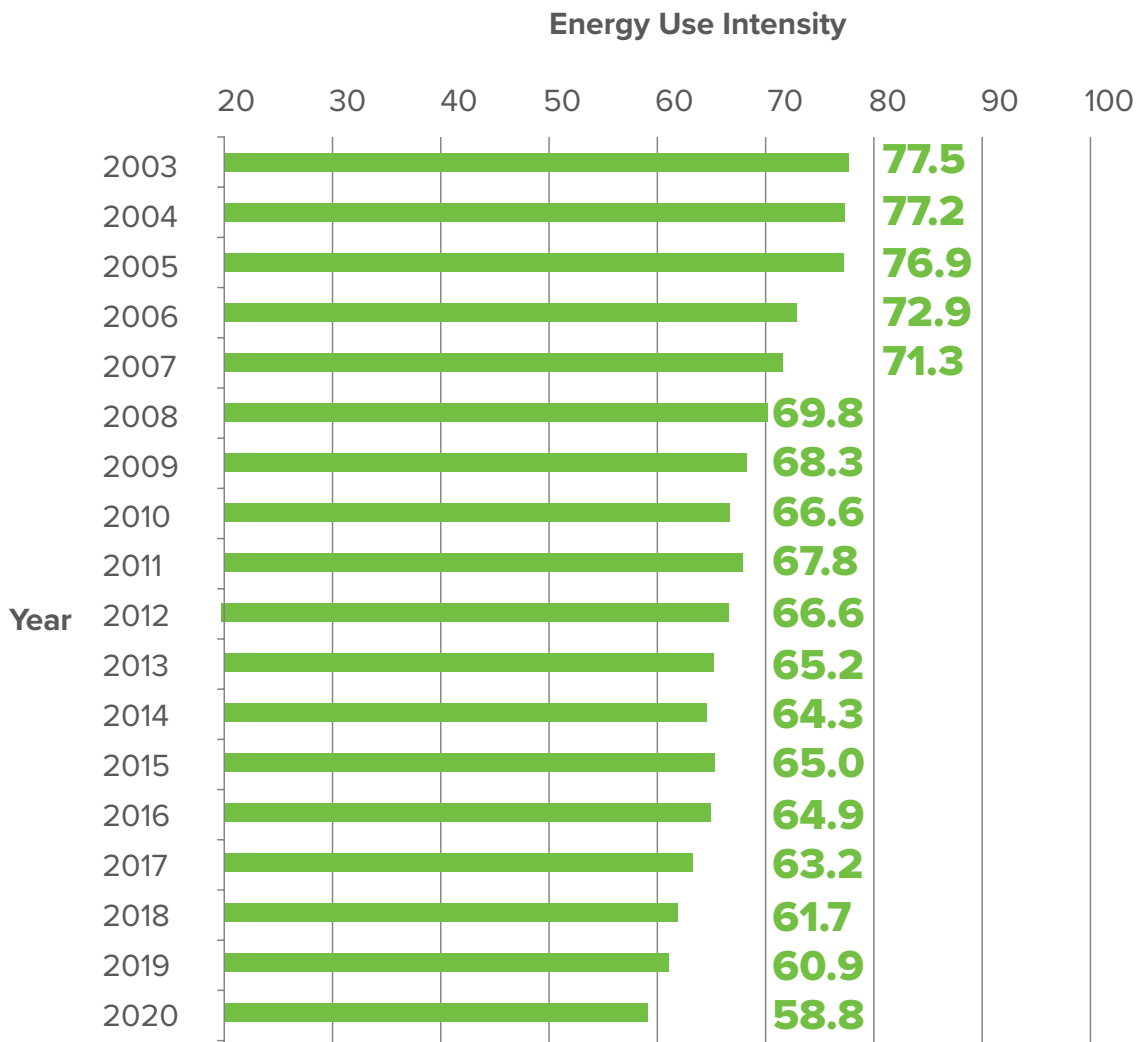
<sup>9</sup> <https://on.nrdc.org/3rZSUjb>

# INTRODUCTION

## How Are We Using Benchmarking Results To Improve Performance?

Benchmarking is not new to City of Charlotte buildings. The EUI of buildings managed by the city's Department of General Services is calculated using an internal software tool which has contributed to the city avoiding more than 30,000 metric tons of carbon dioxide equivalent emissions since 2003. Several city buildings either currently hold or have previously held the EPA ENERGY STAR® designation. Figure 1 shows the aggregate EUI since 2003 for all benchmarked buildings managed by the facility operations division within the general services department. It demonstrates an average 1.5% annual reduction in EUI over this 17-year period. Per the revised Sustainable Facilities Policy, this proven best practice is being extended to qualifying buildings across all city operations to enable faster decarbonization of the city's entire building stock.

*Figure 1: Historical Average Energy Usage Intensity for Buildings Maintained by the City of Charlotte Department of General Services*





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The policy states that all regularly occupied city-owned and city-managed buildings greater than 5,000 square feet are required to benchmark their EUI on an annual basis unless they have an approved exception request. The city will utilize the benchmarking outcomes to identify the facilities with the highest EUI relative to their national median benchmark as well as to take specific action to improve the performance of those buildings.

This data-driven approach will ensure city buildings most in need of energy performance improvements are targeted and prioritized for capital investments.

Additionally, an annual benchmarking report will be released publicly that contains:

- **Comparisons of city buildings** to relevant EPA ENERGY STAR benchmarking national medians or other relevant benchmarks for more unique building types.
- **Yearly changes in building energy performance** beginning in the second year of this report.
- **The percentage of total energy consumption** by building type.
- **Energy efficiency** project highlights.



# OVERVIEW OF CHARLOTTE PORTFOLIO OF PROPERTIES

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## Benchmarking Property List Breakdown

Included in the City of Charlotte's first benchmarking report are 93 buildings that meet benchmarking criteria set by the Sustainable Facilities Policy and represent more than 7 million square feet of building space. This benchmarked square footage is a segment of the total municipal building space eligible for benchmarking. The remaining building space will be incorporated in subsequent years as staff continues to work through energy usage attribution, data discrepancies and the added complexities of benchmarking larger buildings (e.g. airport terminals), all of which are common challenges when benchmarking large portfolios of buildings.

Benchmarking is often a first step in understanding energy usage and leads to more robust investigations to understand why some of the results yield a performance rating different from what was expected. Examples of these follow-up investigations include:

- **Energy audits:** Systemic analyses of energy use and energy consumption to identify, quantify and report opportunities for improved energy performance.<sup>10</sup>
- **Retrocommissioning:** A comprehensive test of building systems aimed at identifying and correcting operational deficiencies, and enabling optimum energy use.<sup>11</sup>

The primary building types within the city's portfolio are fire stations, police stations, office buildings and vehicle maintenance facilities. Table 1 summarizes the quantity, total square footage and total annual energy use by each of these primary building types. In subsequent sections of this report a more granular analysis and discussion of those various building types is provided. The city also includes in its portfolio facilities built to improve the quality of life of its residents and to promote the city as a tourism destination, including arenas, auditoriums, museums and a convention center. Table 2 lists these facilities and their corresponding building type. There is also a discussion about some of the unique challenges that come with benchmarking these buildings.



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<sup>10</sup> <https://bit.ly/TypesOfEnergyAudit>

<sup>11</sup> <https://bit.ly/RetrocommissioningForBetter>



*Table 1: Summary of Municipal Property Types Benchmarked in This Report*

Property Type	Quantity of Buildings	Total Square Footage	Total Energy Usage (kBtu)
Fire Stations	41	345,882	26,681,879
Police Stations	7	108,836	8,721,962
Office and Administration Buildings	22	1,127,527	78,736,797
Vehicle Maintenance Facilities	6	155,690	16,902,919
Other	17	5,455,584	245,998,550
• Convention Center	• 1	• 1,550,995	• 71,966,168
• Indoor Arena	• 3	• 1,065,950	• 117,548,855
• Museum	• 4	• 950,921	• 48,144,222
• Other-Public Service	• 1	• 36,576	• 1,247,241
• Parking	• 5	• 1,778,771	• 5,241,800
• Social/Meeting Hall	• 1	• 4,760	• 116,620
• Warehouse	• 2	• 67,611	• 1,733,643
<b>TOTAL</b>	<b>93</b>	<b>7,193,519</b>	<b>377,042,109</b>

# OVERVIEW OF CHARLOTTE PORTFOLIO OF PROPERTIES

Figures 2-5 highlight the quantity, total aggregate square footage and percentage of total energy usage for this year's benchmarked buildings broken out by building type. A complete list of buildings benchmarked for this report is included in Appendix A.

*Figure 2: Benchmarked Property Types by Square Footage*

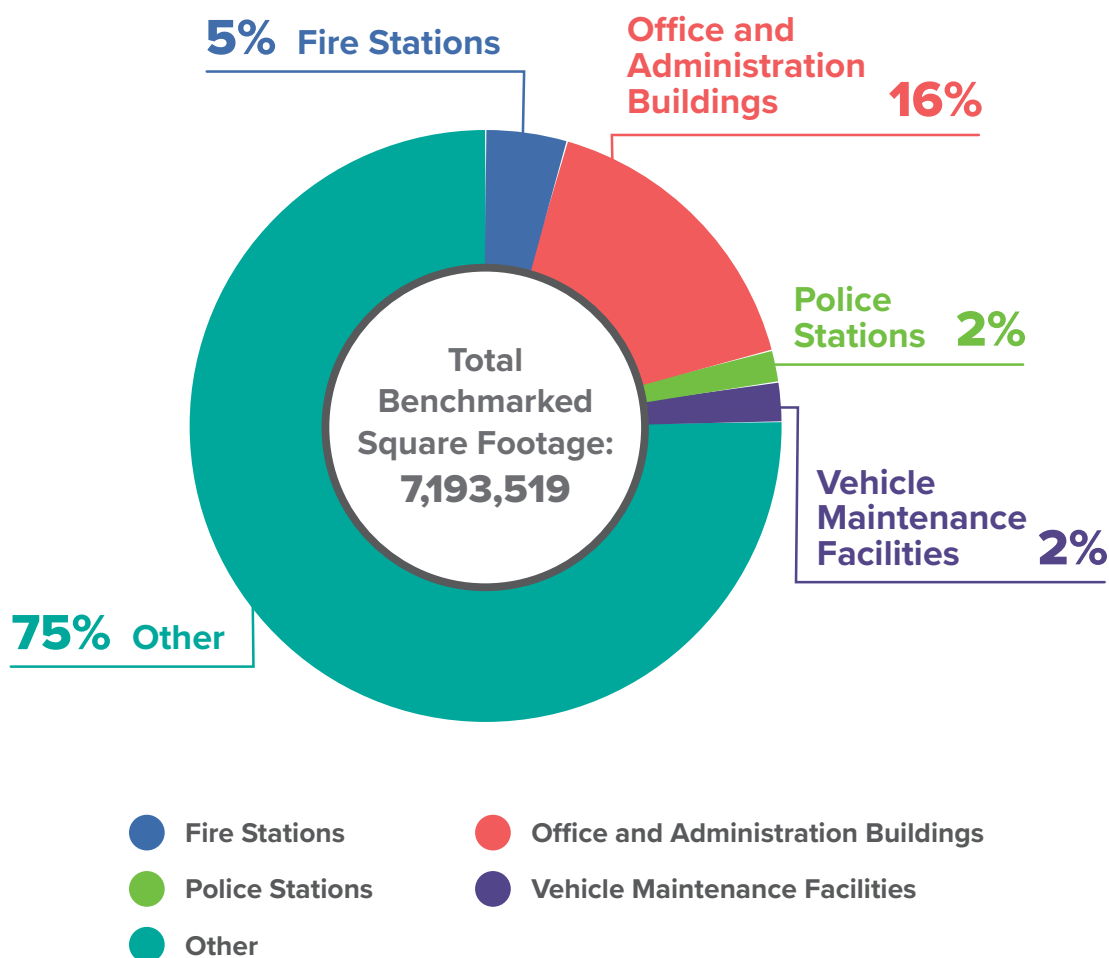


Figure 2 shows the proportion of total building square footage benchmarked this year represented by the primary municipal building types.



*Figure 3: Other Property Types by Square Footage*

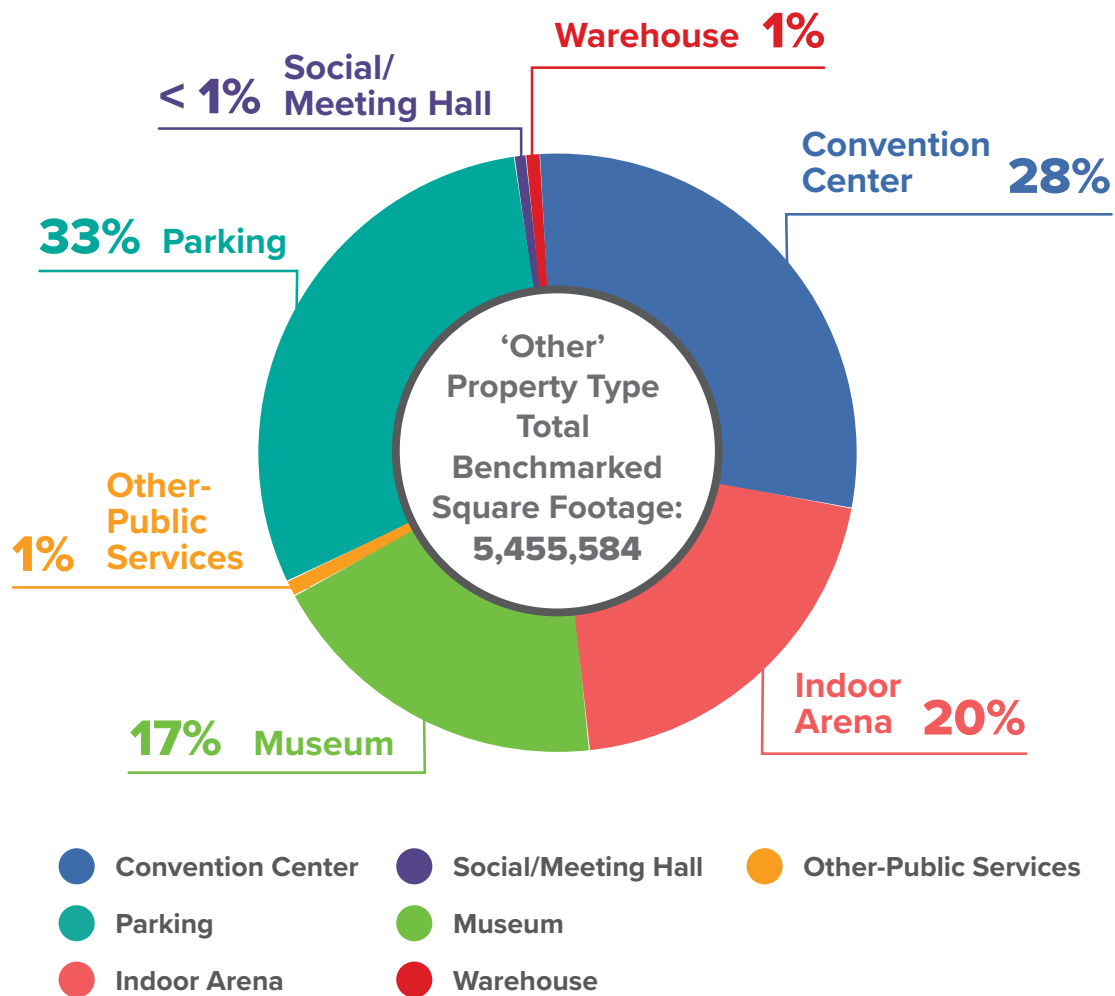


Figure 3 breaks down "other" municipal property types by square footage. This category of buildings is made up mostly of very large buildings such as parking garages, arenas, the convention center and museums.

# OVERVIEW OF CHARLOTTE PORTFOLIO OF PROPERTIES

*Figure 4: Energy Use by Primary Building Type*

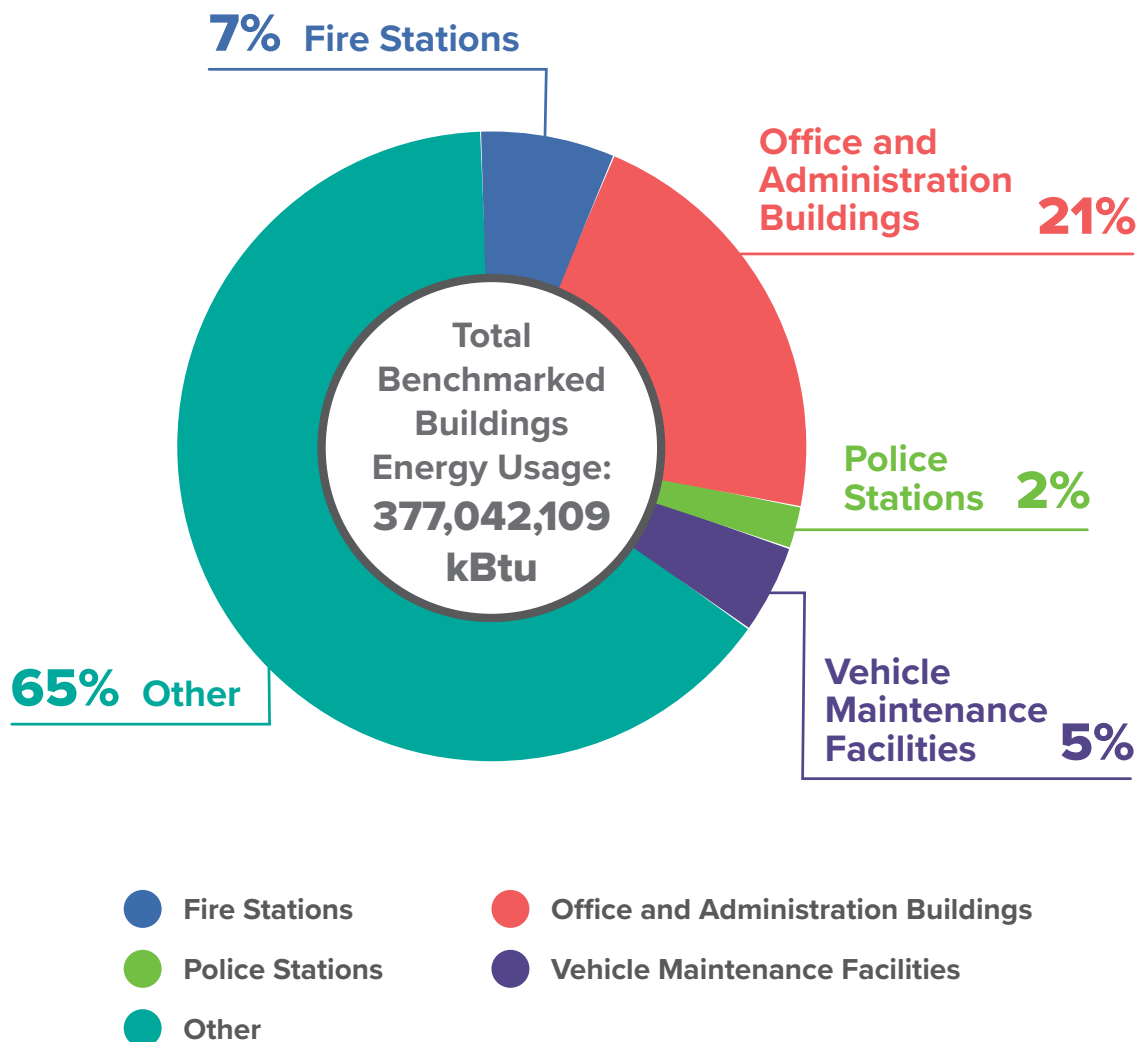


Figure 4 shows the proportion of total building energy usage by the primary municipal building types for this year's benchmarked buildings. These buildings represent a larger proportion of total energy usage relative to square footage.



Figure 5: Energy Usage for 'Other' Building Types

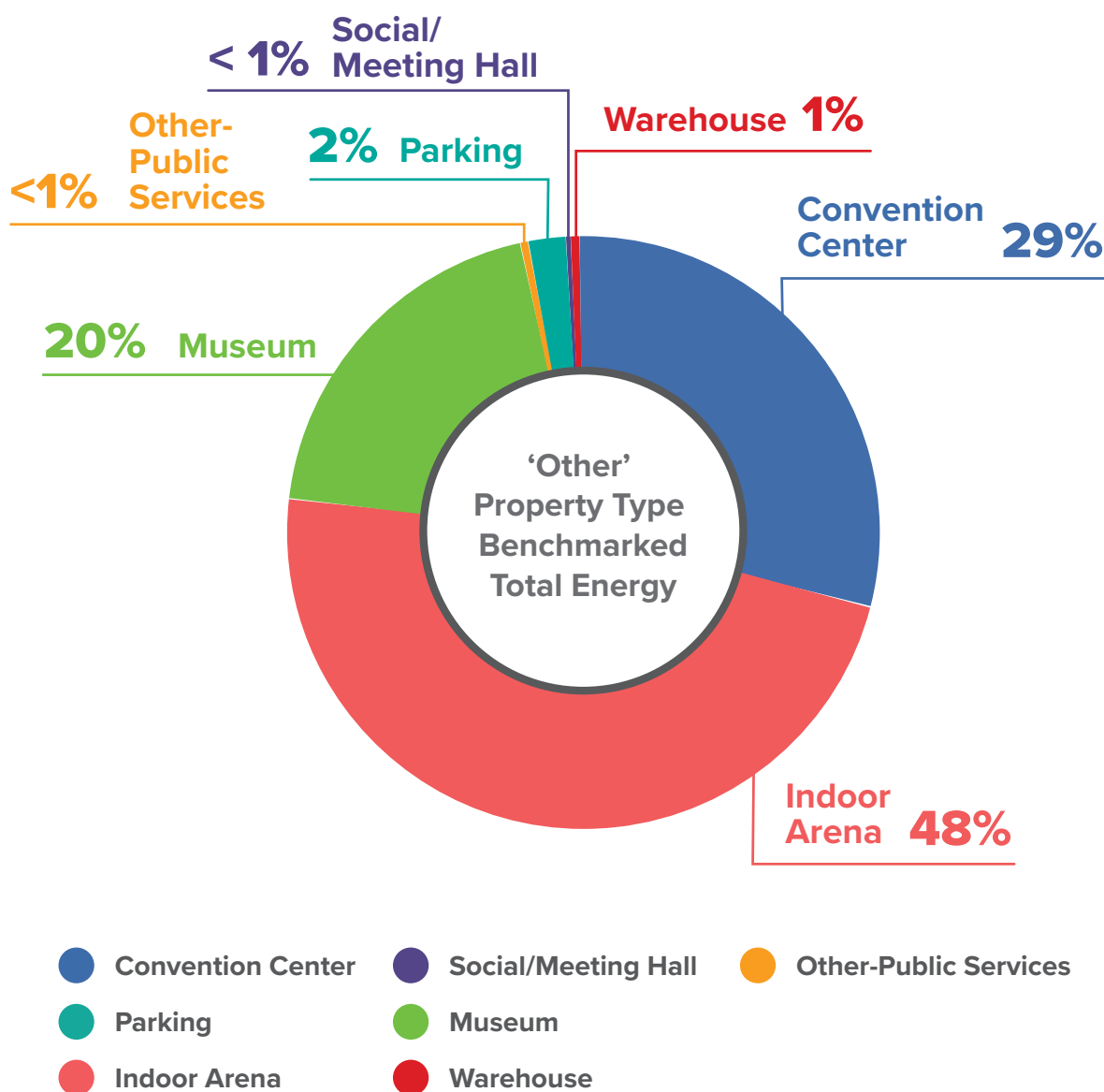


Figure 5 shows energy usage for buildings not represented by those primary building types.

# BENCHMARKING RESULTS BY PROPERTY TYPE

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The Environmental Protection Agency's ENERGY STAR Portfolio Manager relies on data from the national Commercial Building Energy Consumption Survey (CBECS) to establish EUI medians and ENERGY STAR performance thresholds. CBECS collects information on the stock of U.S. commercial buildings, including their energy-related building characteristics and energy usage data. CBECS includes building types that might not traditionally be considered commercial, such as schools, hospitals, correctional institutions and buildings used for religious worship, in addition to traditional commercial buildings such as stores, restaurants, warehouses and office buildings.<sup>12</sup> These surveys are typically updated every five years.

Some of the predominant building types in municipal building portfolios, such as police and fire stations, are not as heavily represented in CBECS as other commercial building types. For this reason, Portfolio Manager scores are not generated for those buildings and those buildings are not eligible to earn the ENERGY STAR designation. Given this smaller sample size, the median EUI values are a less reliable benchmark to compare municipal building energy performance to, and an individual building's EUI relative to national medians is not necessarily an accurate indicator of building energy performance. These comparisons are still useful for assessing relative energy performance of building portfolios and guiding future capital investments.

## Offices

All departments within the City of Charlotte require office space to conduct administrative activities that support each department's mission. Office space represents the largest percentage of primary municipal building type benchmarked in this report and much of that square footage is concentrated in a handful of large buildings like the Charlotte-Mecklenburg Government Center.

Office space is one of the building types eligible for a 1-100 score in Portfolio Manager, and the higher the Portfolio Manager score, the better the energy performance of the building. Office buildings are therefore eligible to earn the ENERGY STAR award, which is awarded to buildings that achieve a Portfolio Manager score of 75 or higher. ENERGY STAR-certified buildings have an energy performance that is better than 75% of buildings nationally with the same use classification.

*Of the 20 municipal office buildings benchmarked in this report, 16 are performing better than the national median Portfolio Manager score of 50. Nine of those 20 buildings have Portfolio Manager scores of 75 or higher, making them eligible to become ENERGY STAR® certified.*

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<sup>12</sup> <https://bit.ly/EnergyConsumptionSurvey>



*Figure 6: Benchmarking Results for Municipal Office*

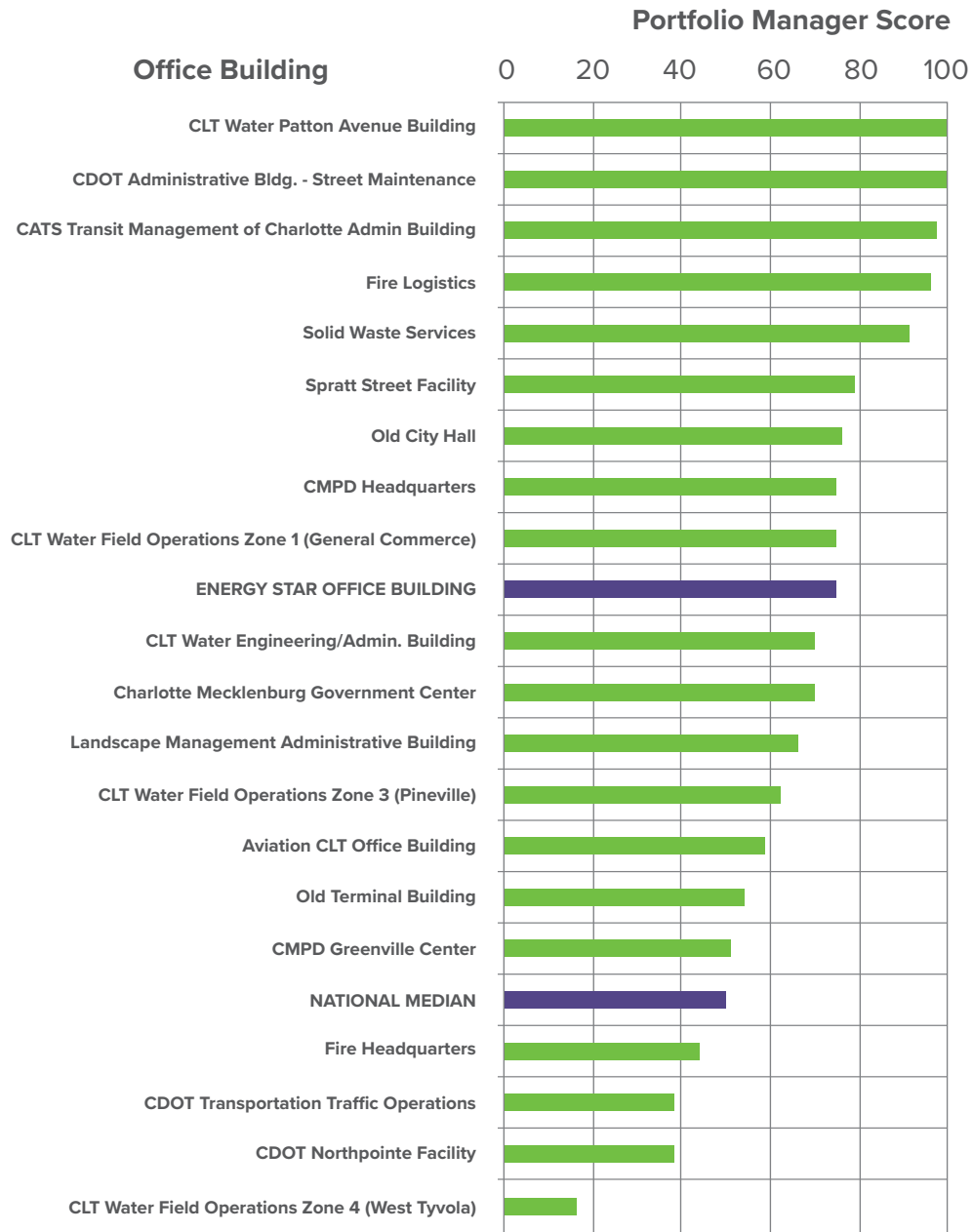


Figure 6 shows the Portfolio Manager scores of all benchmarked office buildings within the city's municipal building portfolio.

# BENCHMARKING RESULTS BY PROPERTY TYPE

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## High Performing Office Building Showcase

Charlotte's Old City Hall has maintained a Portfolio Manager score of 75 or higher for eight years. The city has taken the steps to have Old City Hall's energy use and building attribute data independently verified, thereby earning the ENERGY STAR for buildings award for the eighth consecutive year, beginning in 2014. This sustained record of achievement is due to implementing important energy conservation measures as well as proper maintenance of efficient building systems over time.

Building equipment experience deterioration and wear and tear that can cause energy performance to drift away from intended performance over time. Studies from Texas A&M University and Lawrence Berkeley National Laboratory have shown that this drift can erode energy performance by 10% to 30% in as little as two years.<sup>13</sup> The city's inclusion of retrocommissioning in the Sustainable Facilities Policy as a remedy for buildings with low Portfolio Manager scores and/or high EUIs will serve to minimize the impact of energy performance drift in existing buildings.

*Old City Hall*



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13 <https://bit.ly/BuildingCommissioning>



The remaining primary municipal building types covered in this report are not eligible for a 1-100 score in Portfolio Manager because those building types have low representation in CBECS. These buildings can still be benchmarked in Portfolio Manager, but additional building use characteristics such as operating hours and number of employees do not factor into the building energy performance rating. For these buildings, EUI rather than Portfolio Manager score is the comparison metric, and lower EUIs indicate better building energy performance.

## Police Stations

The Charlotte-Mecklenburg Police Department (CMPD) is the largest metropolitan police department between Atlanta and Washington, D.C. CMPD employs 1,900 sworn officers, 539 civilian employees and 376 volunteers.

CMPD's building portfolio includes 12 police stations, seven of which are included in this benchmarking report. The benchmarking results of those buildings are discussed later. CMPD also occupies buildings not used as police stations. These other CMPD buildings are grouped in this report according to their appropriate use type (e.g. office building, storage, etc.).

*Figure 7: Benchmarking Results for Charlotte-Mecklenburg Police Department Stations*

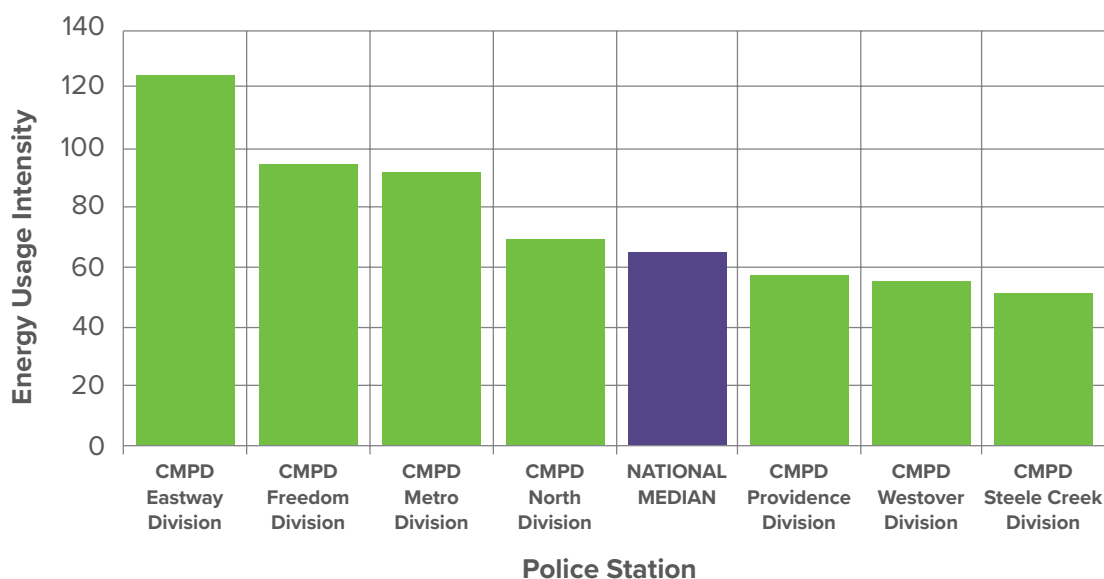


Figure 7 shows the EUI of all CMPD stations that have been in operation for at least 12 months. Five police stations are not included in the report because they are either a new CMPD station or the existing station relocated to a new building less than 12 months prior to reporting.

# BENCHMARKING RESULTS

## BY PROPERTY TYPE

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Figure 7 indicates that three CMPD stations are performing better than the national median and four CMPD stations are performing below the national median. Those three higher-performing buildings are newer police stations, constructed since 2011. Changes in the State of North Carolina's governing energy code at the time of construction and/or use of more energy efficient design features have likely benefited newer police stations. Energy efficient geothermal heat pumps became a standard design feature for CMPD stations several years ago due to a larger focus on energy conservation at the city. Use of geothermal heat pumps explains why the newer police stations have a better EUI than police stations constructed prior to use of geothermal heat pumps.

CMPD's Eastway Division station was constructed after geothermal heat pumps became a standard design feature for CMPD stations, however, the EUI of that building is higher than other CMPD stations with geothermal heat pumps. Due to budget constraints at the time of construction for the Eastway station, the geothermal heat pump feature was value engineered out of its design to reduce construction costs. Although budget constraints can force difficult decisions in building design, in this example, the impact of those decisions affected energy usage and operating expenses in the following years.

The city is already taking steps to improve the energy performance in police stations. Five police stations are currently installing rooftop solar photovoltaic energy systems to generate clean, renewable energy on-site, which will reduce their grid energy consumption and EUI. Those stations are in CMPD's Freedom, Westover and Steele Creek divisions, as well as the South and Independence divisions, but the South and Independence divisions are not included in this year's benchmarking report. Those systems are expected to be installed and operational in time to impact next year's benchmarking scores.

***Energy efficient geothermal heat pumps became a standard design feature for CMPD stations several years ago due to a larger focus on energy conservation at the city. Use of geothermal heat pumps explains why the newer police stations have a better EUI than police stations constructed prior to use of geothermal heat pumps.***



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## High Performing Police Station Showcase

CMPD's Westover Division is home to one of the city's newer police stations. This building was awarded the Leadership in Energy and Environmental Design (LEED) certification in 2017 by the U.S. Green Building Council, and it was the first building in North Carolina to be LEED-certified under the LEED v4 Building Design and Construction criteria. The Westover station uses energy efficient LED lighting throughout the interior and exterior spaces. LEDs are approximately 30% more energy efficient than traditional interior fluorescent lighting and are even more efficient in external lighting applications. LEDs have a much longer useful life, yielding both energy and maintenance savings for city operations.

*Charlotte-Mecklenburg Police Department Westover Division Station*



The Westover station also uses geothermal heat pumps to heat and cool the building. These systems enable heat exchange with the ground just beneath the earth's surface, reducing the need for heat that would otherwise be generated through fossil fuel combustion in a furnace or boiler.

# BENCHMARKING RESULTS BY PROPERTY TYPE

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According to EPA, “geothermal heat pumps can reduce energy consumption — and corresponding emissions — up to 44% compared to air-source heat pumps, and up to 77% compared with electric resistance heating with standard A/C equipment.”<sup>14</sup>

As a result of these energy efficiency solutions, the CMPD Westover Division station performs approximately 13% better than the national median for police stations.

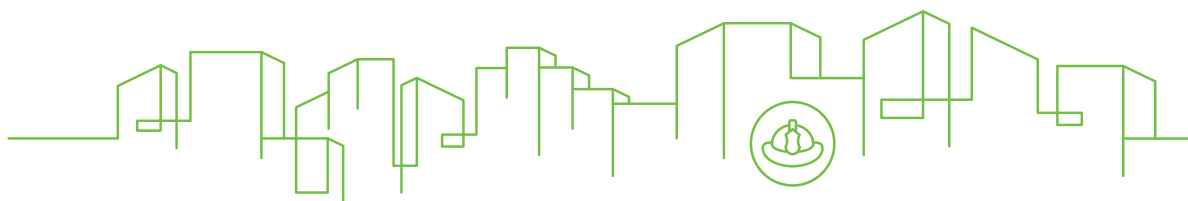
## Fire Stations

The Charlotte Fire Department delivers fire suppression, emergency medical services, technical rescue including urban search and rescue teams, hazardous materials mitigation, fire prevention, domestic preparedness, safety education and fire investigation programs. The fire department provides protection to more than 900,000 people in Charlotte and Mecklenburg County area.

The fire department’s building portfolio includes 43 fire stations. The department also occupies buildings not used as fire stations. These other buildings are grouped in this report according to their appropriate use type. Fire stations are another building type not eligible to receive a 1-100 score in Portfolio Manager, so the energy performance metric is EUI rather than a Portfolio Manager score.

Figure 8 shows the EUI of all Charlotte fire stations in operation for at least 12 months. Of the 41 fire stations benchmarked in this year’s report, 10 have an energy performance better than the national median. Charlotte fire stations operate 24 hours a day, seven days a week, and those stations also include sleeping quarters for firefighters. These building use characteristics are not universal to fire stations nationwide, making the national median for fire stations a less reliable indicator of building energy performance.

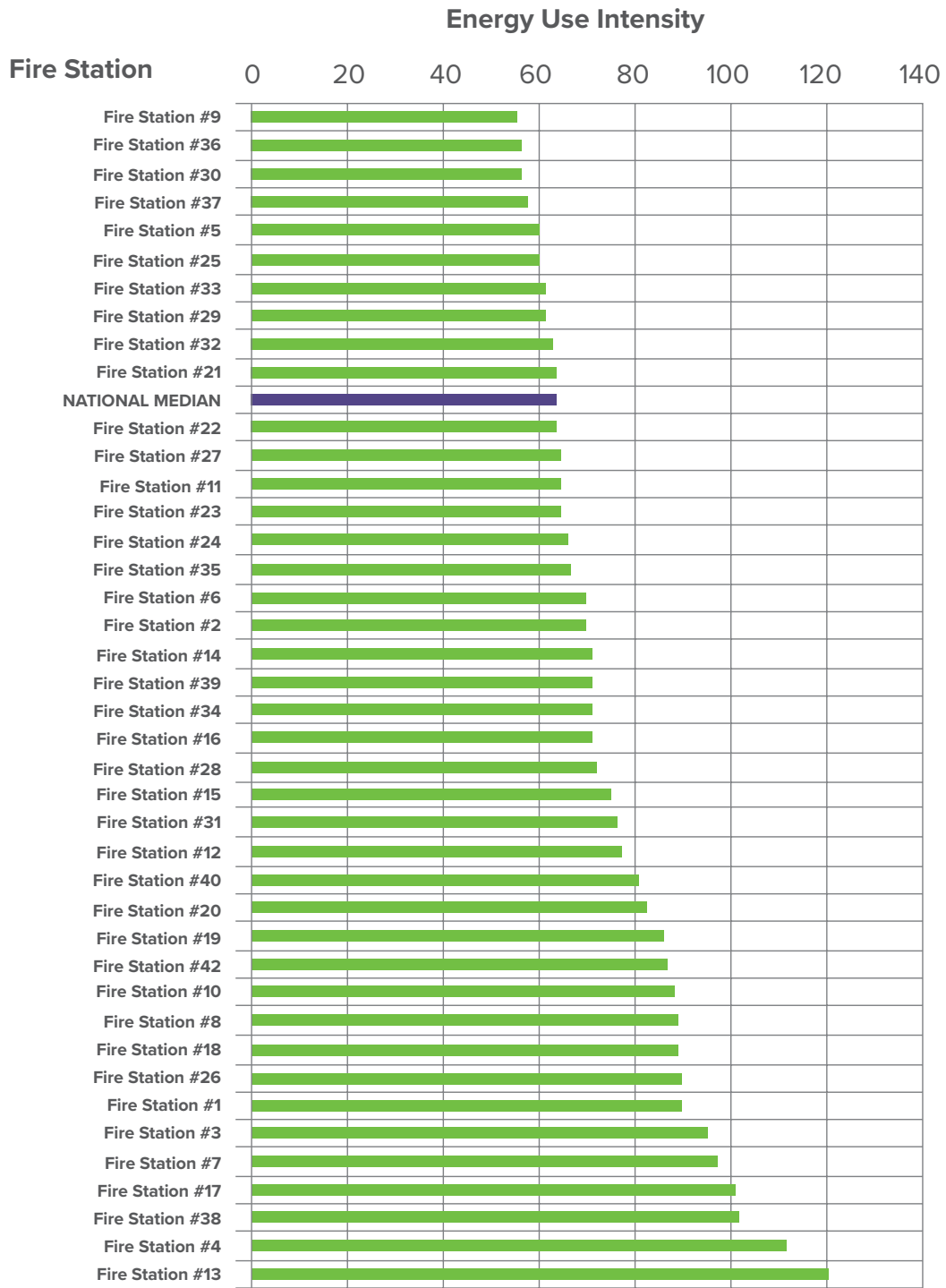
While use characteristics are nuanced, energy performance results suggest that there are opportunities to achieve substantial energy savings by scaling the existing energy conservation measures of higher performing fire stations to the remaining fire stations and identifying new energy conservation measures to apply broadly in all fire stations.



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<sup>14</sup> <https://bit.ly/InstallingGeothermalHeatPumps>

*Figure 8: Benchmarking Results for Charlotte Fire Department Stations*





# BENCHMARKING RESULTS BY PROPERTY TYPE

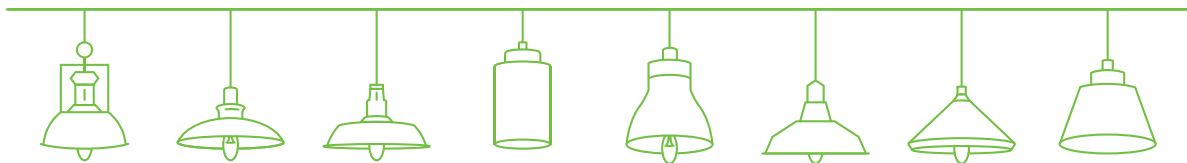
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## High Performing Fire Station Showcase

Fire Station #33 is one of the city's best performing fire stations. This station was constructed in 2000, which predates more stringent state energy code requirements. However, this building has been retrofitted to implement several energy conservation measures that have contributed to its strong energy performance.

One of the energy efficiency features of Fire Station #33 is its LED lighting system retrofit. The facility underwent de-lamping, which involves removing superfluous fixtures not needed to deliver recommended light levels to the space. Not only does de-lamping save energy and reduce maintenance burden, Duke Energy incentivizes it through its **Commercial Lighting Rebates program**. As other fire stations are retrofitted to LED fixtures, the city will evaluate de-lamping opportunities to further improve energy performance.

*One of the energy efficiency features of Fire Station #33 is its LED lighting system retrofit. The facility underwent de-lamping, which involves removing superfluous fixtures not needed to deliver recommended light levels to the space. Not only does de-lamping save energy and reduce maintenance burden, Duke Energy incentivizes it through its Commercial Lighting Rebates program.*



### *Charlotte Fire Department Station #33*



## Vehicle Repair Garages

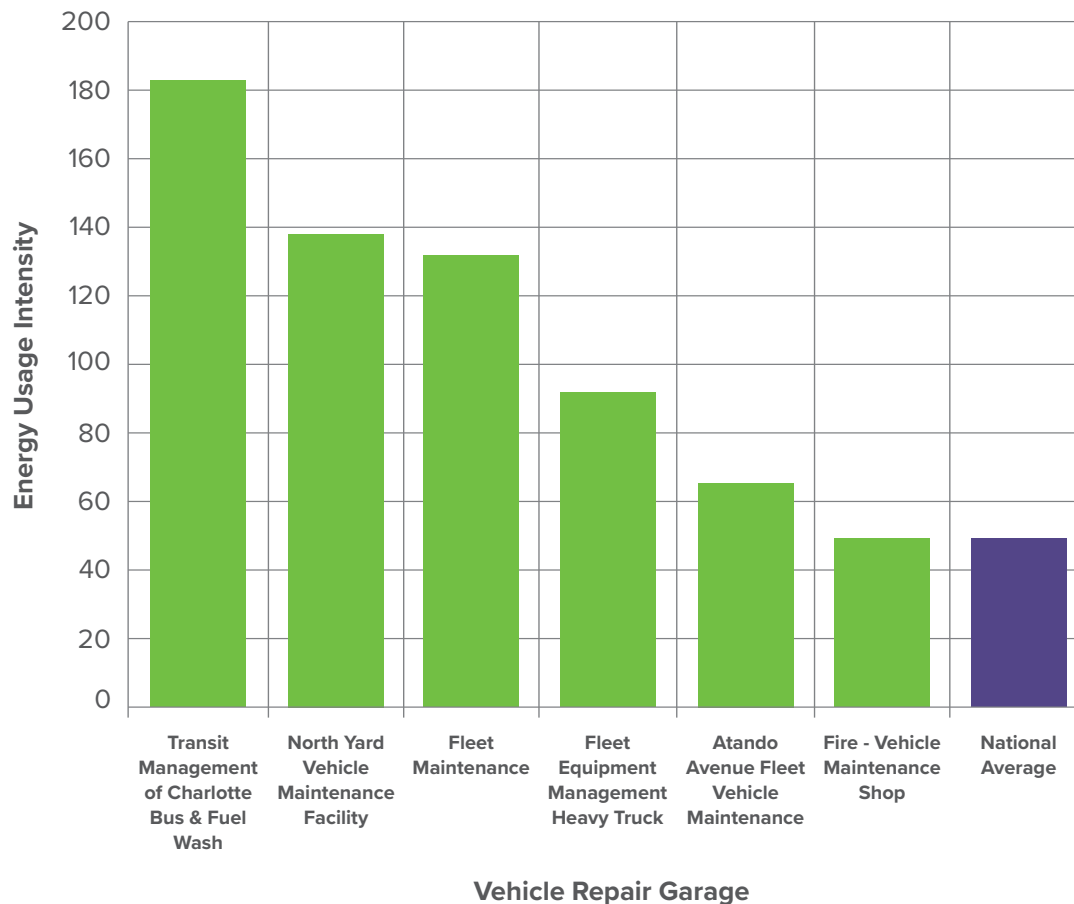
Municipal vehicles are another important asset essential to providing services to residents. Municipal vehicles include buses, vans and train cars used in public transit; trucks for waste and recycling pickup; light-duty trucks and sedans for other day-to-day operations; and police cars and fire trucks to respond to emergencies and maintain public safety. To ensure these vehicles remain in service, the city maintains several vehicle repair garages to perform preventative maintenance and repair work.

Like police and fire stations, vehicle repair garages are unique buildings and are not eligible to receive a 1-100 score in Portfolio Manager. Figure 9 demonstrates that the EUI results for all six of the city's vehicle maintenance garages included in this report are above the national median. In addition, the energy performance varies widely across these buildings. Although there are energy conservation measures that could be applied broadly across all garages to improve performance, improving the energy performance of these buildings will likely require individual solutions as each garage differs in its operation.

Retrocommissioning and/or energy audits can yield a set of measures suited to improving energy performance in these unique vehicle repair garages.

# BENCHMARKING RESULTS BY PROPERTY TYPE

*Figure 9: Benchmarking Results for Vehicle Repair Garages*



## Other Benchmarked Municipal Buildings

Additional municipal buildings that do not fall into one of the primary building use types did have their energy performance benchmarked this year. However, this report does not include the benchmarking scores nor a corresponding discussion for those buildings. This choice was made because (a) those buildings experienced a comparatively large change in energy usage due to COVID-19 pandemic precautions, making the EUI less indicative of the normal energy use profile for these buildings, and (b) due to the low representation of these building types in CBECS, the national median EUI is a less reliable reference point of comparison to assess energy performance. These complexities make accurate energy performance comparisons for these buildings challenging. As these buildings continue to return to normal operating conditions, staff are working jointly with the operators of these buildings to identify more useful benchmarking references and enable more accurate benchmarking of these buildings in future years.



*Table 2: Other Benchmarked Properties*

Property Name	Building Type
Charlotte Department of Transportation Monroe Road Warehouse	Warehouse
CMPD North Graham Street Storage	Warehouse
Charlotte Convention Center	Convention Center
Spectrum Center	Indoor Arena
Ovens Auditorium	Social/Meeting Hall
Bojangles Coliseum	Indoor Arena
Mint Museum Uptown	Museum
NASCAR Hall of Fame	Museum
Mint Museum Randolph	Museum
Harvey B. Gantt Center for African-American Arts + Culture	Museum
Belmont Regional Center	Other-Public Services
Wilmore Center	Social/Meeting Hall

# CONCLUSIONS

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Charlotte is making progress toward its 2030 goal of fueling its municipal buildings from zero-carbon sources. Recent accomplishments include a 35-megawatt solar energy project through Duke Energy's Green Source Advantage program, the revised Sustainable Facilities Policy and budget allocations enabling more than 1 megawatt of on-site solar energy to be installed across multiple municipal buildings.

Because buildings represent a significant amount of the city's municipal carbon footprint, there are opportunities to make strategic investments in both energy efficiency and renewable energy for buildings to advance carbon reduction goals. The benchmarking work enabled through the Sustainable Facilities Policy and subsequent actions taken for the buildings with energy performance in the bottom quartile will support yearly progress. Specifically, benchmarking will help develop a roadmap for energy efficiency work and enable the city to optimize future energy efficiency and renewable energy investments.

This report confirms that there are important energy conservation opportunities that remain within municipal buildings, and the city's strategy towards its zero-carbon should continue to prioritize energy efficiency in buildings.

The city will continue to update its benchmarking scores annually and share results to demonstrate how benchmarking can enable year-over-year savings and carbon emissions reductions. As the city continues to lead, the goal is that industrial, commercial, and multifamily residential building owners in Charlotte will follow the city's lead, with regular benchmarking and publicly sharing results. Broad participation will propel the community toward becoming a low-carbon city by 2050.

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# APPENDIX A

## COMPLETE LIST *of* BENCHMARKED PROPERTIES

New Property Name	City of Charlotte Division or Department
Atando Avenue Fleet Vehicle Maintenance	General Services
Charlotte Douglas International Airport (CLT) Office Building	Aviation
Belmont Regional Center	General Services
Bojangles Coliseum	Charlotte Regional Visitors Authority (CRVA)
Charlotte Area Transit System (CATS) Interstate 485 Parking Garage	CATS
CATS North Yard Vehicle Maintenance Facility	CATS
CATS Sugar Creek Parking Deck	CATS
CATS Transit Management of Charlotte Admin Building	CATS
CATS Transit Management of Charlotte Bus and Fuel Wash	CATS
CATS University City Boulevard Parking Deck	CATS
Charlotte Department of Transportation (CDOT) Administrative Building - Street Maintenance	CDOT
CDOT Monroe Road Warehouse	CDOT
CDOT Northpointe Facility	CDOT
CDOT Transportation Traffic Operations	CDOT
Charlotte-Mecklenburg Government Center	General Services

New Property Name	City of Charlotte Division or Department
CLT Fleet Maintenance	Aviation
Engineering/Admin. Building	Charlotte Water
Field Operations Zone 1 (General Commerce)	Charlotte Water
Field Operations Zone 3 (Pineville)	Charlotte Water
Field Operations Zone 4 (West Tyvola)	Charlotte Water
Patton Avenue Building	Charlotte Water
CMPD Eastway Division Station	Police
CMPD Freedom Division Station	Police
CMPD Greenville Center Station	Police
CMPD Headquarters	Police
CMPD Metro Division Station	Police
CMPD North Graham Street Storage	Police
CMPD North Division Station	Police
CMPD Providence Division Station	Police
CMPD Steele Creek Division Station	Police

# APPENDIX A

## COMPLETE LIST *of* BENCHMARKED PROPERTIES

New Property Name	City of Charlotte Division or Department
CMPD Westover Division Station	Police
Charlotte Convention Center	CRVA
Charlotte Fire Department - Vehicle Maintenance Shop	Fire
Charlotte Fire Department Headquarters	Fire
Fire Logistics	Fire
Fire Station #1	Fire
Fire Station #2	Fire
Fire Station #3	Fire
Fire Station #4	Fire
Fire Station #5	Fire
Fire Station #6	Fire
Fire Station #7	Fire
Fire Station #8	Fire
Fire Station #9	Fire
Fire Station #10	Fire



New Property Name	City of Charlotte Division or Department
Fire Station #11	Fire
Fire Station #12	Fire
Fire Station #13	Fire
Fire Station #14	Fire
Fire Station #15	Fire
Fire Station #16	Fire
Fire Station #17	Fire
Fire Station #18	Fire
Fire Station #19	Fire
Fire Station #20	Fire
Fire Station #21	Fire
Fire Station #22	Fire
Fire Station #23	Fire
Fire Station #24	Fire
Fire Station #25	Fire

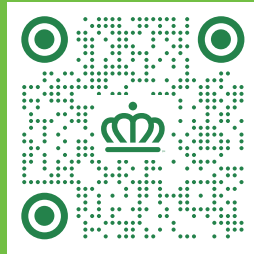
# APPENDIX A

## COMPLETE LIST *of* BENCHMARKED PROPERTIES

New Property Name	City of Charlotte Division or Department
Fire Station #26	Fire
Fire Station #27	Fire
Fire Station #28	Fire
Fire Station #29	Fire
Fire Station #30	Fire
Fire Station #31	Fire
Fire Station #32	Fire
Fire Station #33	Fire
Fire Station #34	Fire
Fire Station #35	Fire
Fire Station #36	Fire
Fire Station #37	Fire
Fire Station #38	Fire
Fire Station #39	Fire
Fire Station #40	Fire
Fire Station #42	Fire

New Property Name	City of Charlotte Division or Department
Fleet Equipment Management Heavy Truck	General Services
Harvey Gantt African American Museum	General Services
Landscape Management Administrative Building	Charlotte
Mint Museum Randolph	General Services
Mint Museum Uptown	General Services
NASCAR Hall of Fame	CRVA
NASCAR Hall of Fame Parking Deck	CRVA
Old City Hall	General Services
Old Terminal Building	Aviation
Ovens Auditorium	CRVA
Solid Waste Services	Solid Waste Services
Spectrum Center	CRVA
Spratt Street Facility	General Services
Sugar Creek Parking Deck	CATS
Wilmore Center	General Services





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