City of Providence
Department of Sustainability

Municipal Energy Report
FY 2022

Acknowledgements

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Glossary

Benchmarking: a means of comparing a building's energy use to the average of similar buildings or to an established baseline.

Building Management System (BMS): a computer-based control system installed in buildings that controls and monitors the building's mechanical and electrical equipment such as boilers and other heating and ventilation equipment, lighting, and security systems, among others. A BMS provides important data that enables facility managers to optimize energy management and minimize operation costs.

Carbon Dioxide Equivalent (CO_2e): a measurement that is a simple way to normalize different greenhouse gases and other climate influences in standard units based on the radiative forcing of a unit of carbon dioxide over a specified timeframe (generally set at 100 years).

Commercial Building Energy Consumption Survey (CBECS): a national sample survey that collects information on the stock of U.S. commercial buildings, including their energy-related building characteristics and energy usage data.

Heating Degree Days (HDD): indicators of energy consumption for space heating. HDD are calculated by taking the average of a day's high and low temperatures and subtracting from 65°. For example: If the day's average temperature is 50° F, its HDD is 15. If every day in a 30-day month had an average temperature of 50°, the month's HDD value would be 450 (15 x 30). HDD data comes from Weather Data Depot, an online weather data hub powered by AccuWeather©

British thermal unit (**Btu**): a unit of heat defined as the amount of heat required to raise the temperature of one pound of water by one degree Fahrenheit. A **kBtu** equals 1,000 **Btu**. An **MBtu**, or **MMBtu**, equals 1,000,000 Btu.

ENERGY STAR ® Score: a measure of a building's energy performance relative to similar properties, when normalized for weather and operational characteristics.

Energy Use Intensity (EUI): measures the energy use per square foot of a building. It is calculated by dividing the total energy consumed by the building in one year by the total gross floor area of the building. *Weather-Normalized* energy use intensity is the energy a property would have used if it had experienced 30-year average temperatures.

Kilowatt Hour (kWh): a unit of energy equal to 3.6 mega joules commonly used as a billing unit for energy delivered to consumers by electric utilities.

Renewable Energy Credit (REC): A Renewable Energy Credit, also known as a Renewable Energy Certificate, is a tradable non-tangible energy commodity equivalent to 1 megawatt-hour (MWh) of electricity generated from a renewable energy source such as solar energy, that has been fed into a power grid.

Site Energy Use: the amount of energy consumed at a specified location. It can be a mix of fossil fuel such as natural gas, and electricity that is transmitted to the facility. It can be measured at the campus, building, or sub-building level and is the basis for energy charges on utility bills.

Shoulder Months: The months of the year when it is between 45 and 65 degrees outside, generally applying to the spring and autumn months, April through June and September through October.

Source Energy Use: Unlike site energy use, source energy use includes losses that take place during the generation, transmission, and distribution of energy.

Steam Trap: A steam trap valve allows for the discharge of condensate and non-condensable gases with a negligible loss of steam.

Variable Frequency Drive (VFD): Applying a variable frequency drive (VFD) to a pump allows control of the pump's speed electronically, while using only the energy needed to produce a given flow, which can reduce electricity consumption in industrial applications.

Watt: a unit of power defined in the International System of Units as a derived unit of 1 joule per second which is used to quantify the rate of energy transfer. A **kilowatt (kW)** equals 1000 watts, and a **megawatt (MW)** equals 1,000,000 watts.

Zero Energy Buildings: buildings that produce at least as much energy as they consume over the course of a year.

Executive Summary

The Providence Municipal Energy Report discloses the City's facility energy data in an effort to track progress towards the City's energy goals, increase transparency, and lead by example. The City's 2014 *Sustainable Providence* plan set a goal to achieve a minimum of 30% energy use reduction by 2030 in all City-owned property. The 2019 Climate Justice Plan goes even further with an objective of eliminating all climate pollution from municipal operations by 2040, specifically by transitioning 100% of municipal buildings' electricity to renewable by 2030, and transitioning 100% of municipal buildings' heating to renewable by 2040. Measuring and monitoring municipal energy consumption by benchmarking buildings and other facilities is critical to ensuring we are achieving and making progress towards these goals. The Sustainability Office has released municipal energy reports annually since FY 2014.

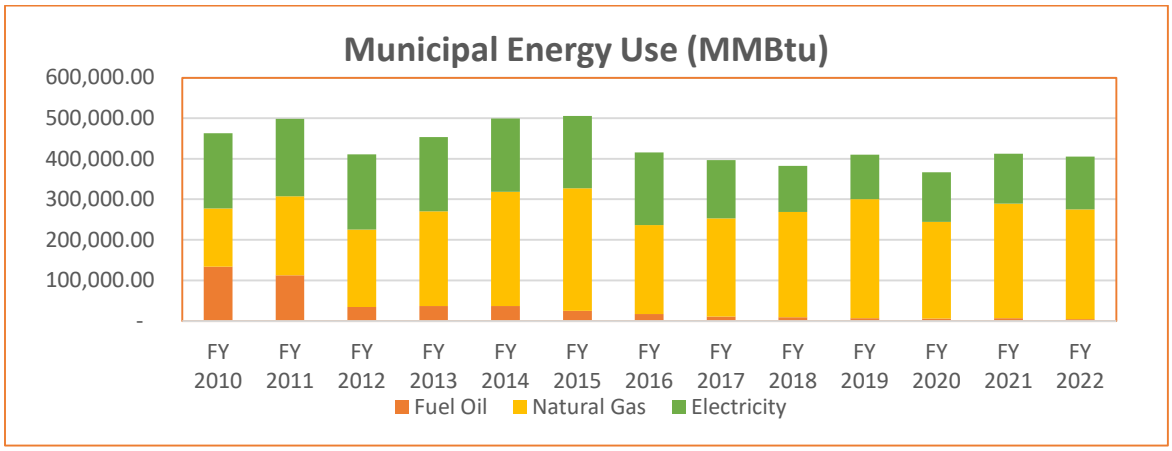

Figure 1: City of Providence's electricity, natural gas, and fuel oil consumption, FY 2010 - FY 2022. (Non-weatherized or operationally adjusted usage)

The City of Providence has been benchmarking and monitoring its energy consumption as part of its fiscal and environmental agenda since 2010. The Office of Sustainability uses the U.S. Environmental Protection Agency's ENERGY STAR Portfolio Manager to track all of the electric, natural gas, and oil used by City facilities. This data helps the City manage its energy consumption and identify opportunities for investment and savings. The Covid-19 pandemic and capacity issues within the Office of Sustainability delayed development of the FY 2022 Municipal Energy Report. That said, this marks the 8th annual municipal energy report released by the Office of Sustainability. This FY 2022 Municipal Energy Report features FY 2022 (July-June) energy data. The City's facilities, including buildings and outdoor lighting, used 404,914 MMBtus of energy in FY 2022 in the form of electricity, natural gas, and oil. FY 2022 encompassed July 2021 to June 2022. The information in this report summarizes the full dataset.

Key Findings:

- The City used 404,914 MMBtus of energy in FY2022, a 13% reduction from our baseline year of FY 2010. Consumption was down 2% in comparison to FY2021
- For the 5th consecutive year, the State's Office of Energy Resources recognized Providence with its Lead by Example Clean Energy Award. In 2022, the City of Providence was recognized for its purchase of 15 Nissan LEAF S electric vehicles to replace existing vehicles in the fleet
- The City's expenditures on energy have declined by 28% since FY 2010, a slight increase from last year due to higher prices of natural gas
- Greenhouse gas emissions from municipal facilities have decreased by 28% since FY 2010, the result of cleaner fuels, LED lighting conversions, and heating system upgrades.
- The total electricity usage of municipal buildings was 38.2 million kWh in FY22, down 29.91% from 54.5 million kWh in 2010. However, the City's electricity use has trended upward since FY 2018. Why?
    - As we aim to electrify the heating of municipal buildings, as well as the municipal fleet, we expect electricity usage to increase as fossil fuel usage declines.
- The City has reduced #2 fuel oil consumption by almost 97% since 2010. Heating oil was eliminated from all City-owned school buildings as of December 2016.
- The City's LED retrofit of its streetlights has saved over 31.3 million kWh and prevented 22,140 metric tons of CO_2 from entering the atmosphere since 2016This project has saved the City about $4.8 million after project loan payments.
- 38 buildings out of 86 have decreased their Weather Normalized Site EUI in comparison to FY 2021.

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INTRODUCTION

The City of Providence has been monitoring its energy consumption as part of its fiscal and environmental agenda since 2010. The Providence Municipal Energy Report presents the City's energy data publicly to showcase this work and increase transparency and accountability. It also highlights the City's leadership in making investments in energy efficiency and renewable energy over the past several years. Providence's clean energy measures have been recognized annually by the Rhode Island Office of Energy Resources (RI OER)'s *Lead by Example Award*. In 2022 and 2020 the City of Providence was recognized for the purchase of 15 electric vehicles to replace existing vehicles in the fleet, as well as the installation of its first municipally owned EV charging stations. The City was recognized in 2019 for its part in the development of a 23 MW solar array and virtual net metering project to generate electricity equivalent to most of Providence's municipal electricity needs. In 2018 and 2017, the *Lead By Example Award* highlighted Providence's investments in LED streetlights and lighting upgrades and retrofits at city-owned buildings and city parks.

The 2014 sustainability plan, *Sustainable Providence,* set a goal for the City to "achieve a minimum of 30% energy use reduction by 2030 on all City-owned property." To meet this goal, the plan calls for investments in energy efficiency projects as well as clean and renewable energy. In 2015, Mayor Elorza called for the plan to be expanded to also include a greenhouse gas reduction goal. This was marked by his joining the *Global Covenant of Mayors for Climate & Energy* (GCOM), a global coalition of mayors pledging to reduce greenhouse gas emissions and enhance climate resilience. On Earth Day of 2016, Mayor Elorza reinforced his commitment to climate action by signing an executive order, committing Providence to becoming a carbon neutral city by 2050. The City reports annually to GCOM through the *Carbon Disclosure Project (CDP)*, which tracks the City's progress on mitigating emissions, and ensuring adaptive, resilient communities and infrastructure.

The 2019 Climate Justice Plan goes even further with a Lead By Example objective of eliminating all climate pollution from municipal operations by 2040, specifically by transitioning 100% of municipal buildings' electricity to renewable by 2030, and transitioning 100% of municipal buildings' heating to renewable by 2040. Leading by example with city-owned schools and facilities represents one of seven key objectives – along with 20+ targets and over 50 strategies – intended to create an equitable, low-carbon and climate resilient city.

As mentioned, measuring and disclosing energy use is foundational to meeting the City's energy and greenhouse gas reduction goals. Under Mayor Elorza's continued leadership on fiscal and environmental responsibility, the City of Providence is following in the

footsteps of many other U.S. municipalities by benchmarking its buildings and publicizing annual energy reports. Benchmarking is the practice of comparing building energy use to other similar buildings or historical data to manage energy consumption. Other cities that have produced similar reports in recent years include San Francisco, Boston, New York, and Seattle. Providence's robust history of benchmarking also stands out as a leader among the public sector in the State of Rhode Island.

The city uses two primary energy management software applications to track all of the City's electric, gas, oil and water usage: the U.S. Environmental Protection Agency's ENERGY STAR Portfolio Manager and Peregrine Focus. These programs allow the city to track performance on past energy efficiency projects, target buildings for new energy conservation measures, and manage energy spending. These annual Municipal Energy Reports provide a transparent and easy-to-understand narrative that informs the public about City energy use.

City Energy Use

Overview

The City's facilities, including buildings and outdoor lighting, used 404,914 MMBtu of energy in FY 2022 in the form of electricity, natural gas, and oil (see Figure 1). As of December 2016, the city has converted most of its oil-fired furnaces to natural gas, which has nearly eliminated the use of fuel oil but increased the use of natural gas. In 2022, natural gas accounted for roughly 66.7% of City facility energy consumption at 270,217.80 MMBtu- down over 4% from FY 2021. Electricity accounted for 32.2% of the City's total energy use at 130,250.57 MMBtu, while #2 heating oil accounted for only 1.1% at 4,447.80MMBtu, an all-time low.

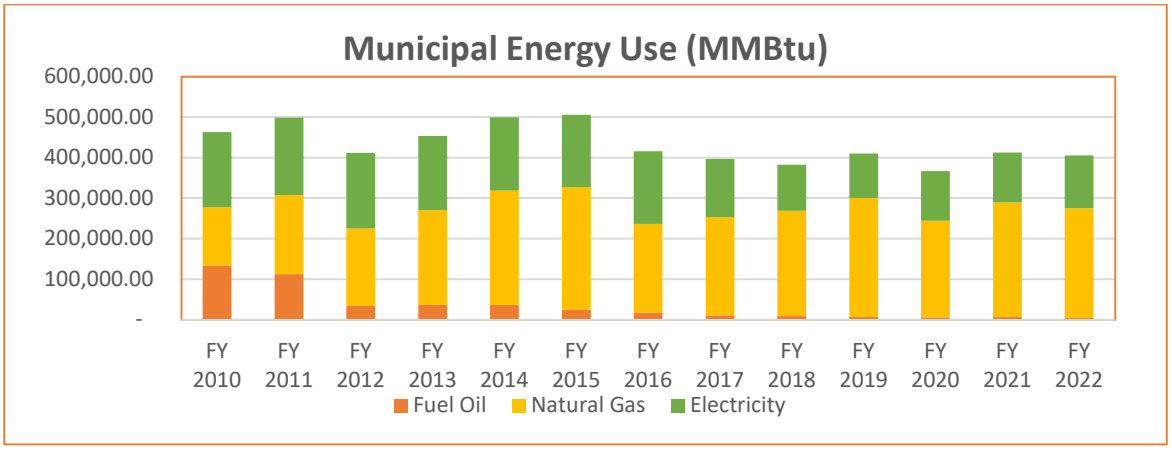


Figure 1: City of Providence's electricity, natural gas, and fuel oil consumption, FY 2010 - FY 2022.

Relative to the City's baseline year of 2010, energy consumption has declined by **13%,** with some year-to-year fluctuations that are mostly attributed to weather patterns. Figure 2 shows the correlation between the City's energy consumption and weather. Weather patterns are tracked by Heating Degree Days (HDD), a standard means of normalizing energy data to weather. For example, 2012 HDD data showed an extremely mild winter; therefore, the City's energy use dropped significantly. Though other factors contribute to variations in energy consumption, such as energy efficiency measures and changes in use and/or operation of the building, weather is typically the primary factor in energy use fluctuations.

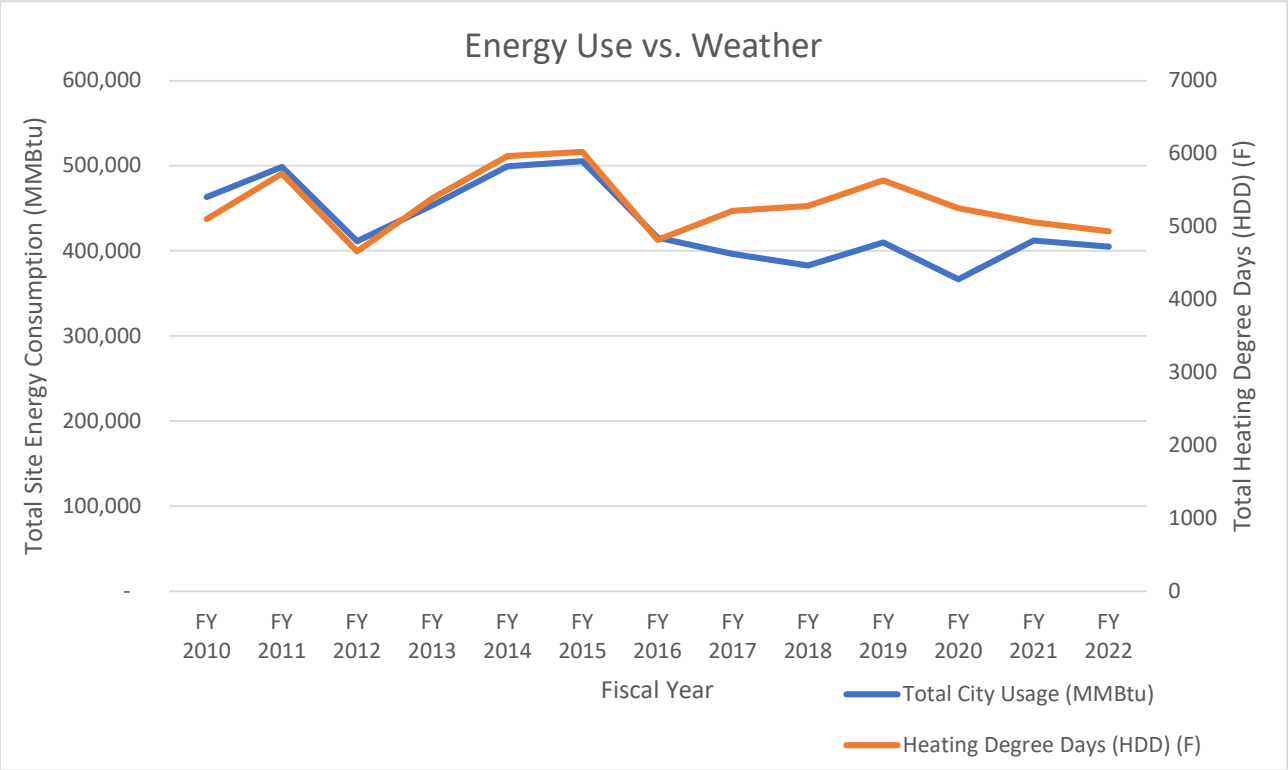


Figure 2: Because a significant amount of energy is needed for heating municipal buildings, weather is a driving factor in overall energy consumption.

Electricity

In FY 2022, the City of Providence used roughly 38,174,259 kWh of electricity, a 30% reduction from its 2010 baseline (see Figure 3). The primary driver for electricity reduction was the conversion of the City's streetlight to LEDs, which occurred in FY 2018. Other factors have included lighting retrofits (LED Lighting Project) at Providence's

schools and municipal buildings, and transitions to more energy efficient electronics and appliances – plug loads. However, since FY 2018, the City of Providence has seen a 14% increase in electricity use. Factors to more closely track in relation to this increase include behavioral energy conservation efforts and the use of building management systems. While we would expect increases in electricity use as we shift away from natural gas for space and hot water heating, significant shifts to heating with electricity have not yet occurred. However. COVID protocols and a national trend for increased plug load usage in both schools and office buildings have been identified as contributing factors.

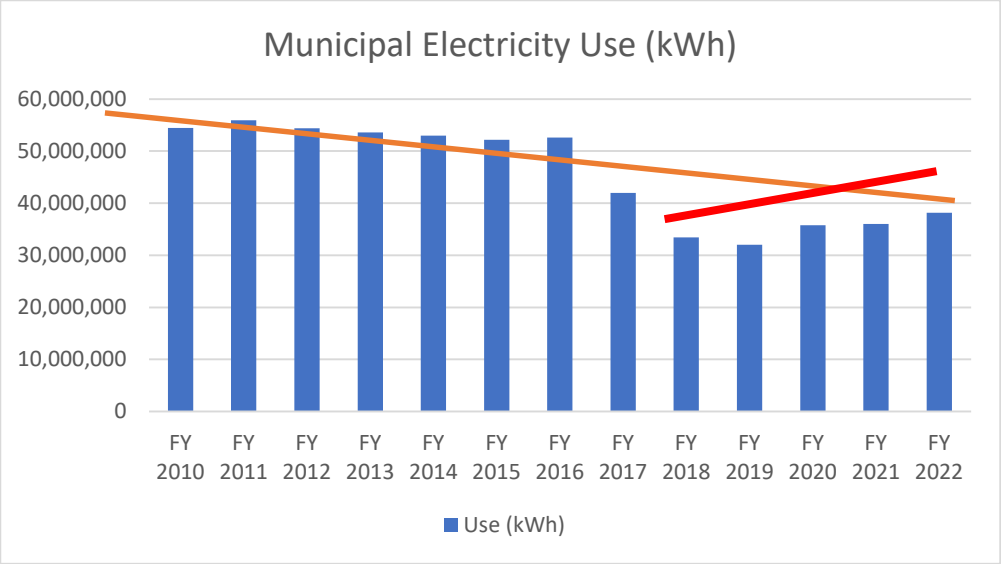


Figure 3: City of Providence's electricity use shown in kWh, FY 2010 – FY 2022. Electricity consumption has declined by 30% since FY 2010. Since FY 2018, electricity consumption has increased by 14%.

Thermal

The City of Providence uses two primary sources of thermal energy for heating its facilities: natural gas and #2 fuel oil. Relative to fuel oil, natural gas is a cleaner-burning fuel. Switching from oil to natural gas provides a considerable greenhouse gas reduction, but it is still a fossil fuel. In addition, a proportion of the site-specific GHG reductions associated with switching to natural gas are negated by the leakage of methane into the atmosphere from upstream drilling and pipeline infrastructure. Furthermore, switching fuels is only considered an energy efficiency measure when performed in concert with energy efficient upgrades such as installing condensing boilers or advanced monitoring systems.

Natural gas remains a cleaner and less expensive alternative to #2 fuel oil, and natural gas-fired boilers require less maintenance, which also helps save the City money. Fuel-switching efforts at City schools began in 2009, and by the end of 2016, #2 fuel oil was

no longer in use in any of the district's buildings. Subsequently, the City has focused efforts on HVAC controls and retro-commissioning for maximum energy savings. The City is currently exploring cleaner alternatives to natural gas such as air source heat pumps, which run on electricity. The Climate Justice Plan, which was released in 2019 calls for 100% of municipal buildings' heating to be renewable by 2040. Converting HVAC equipment to electricity is key to achieving this goal.

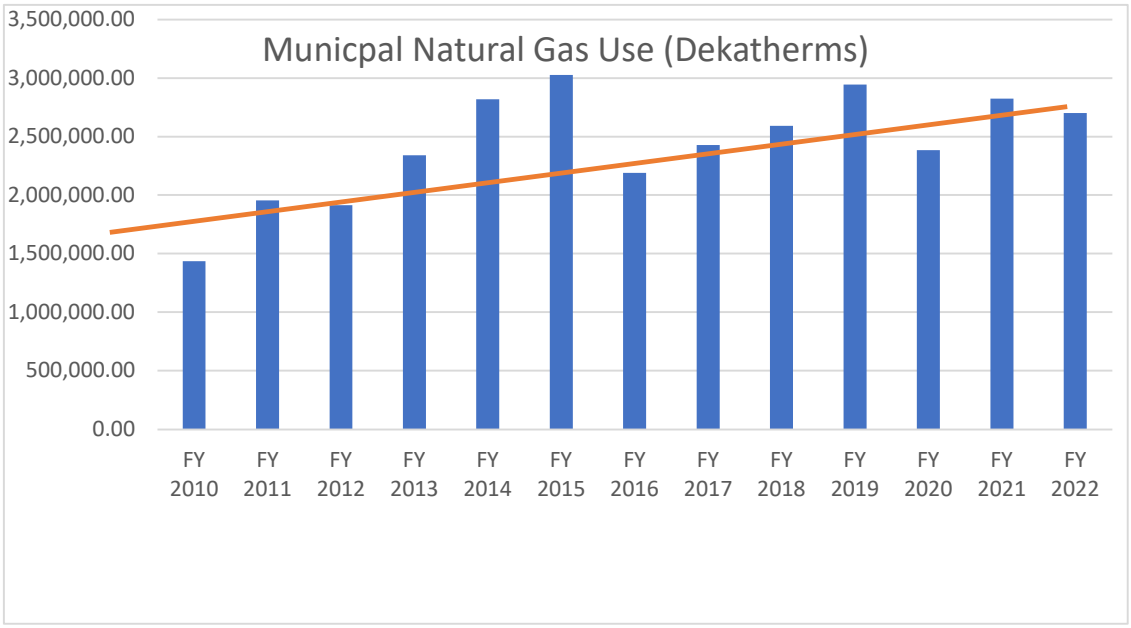


Figure 4: City of Providence's natural gas use, shown in dekatherms, FY 2010 – FY 2022.

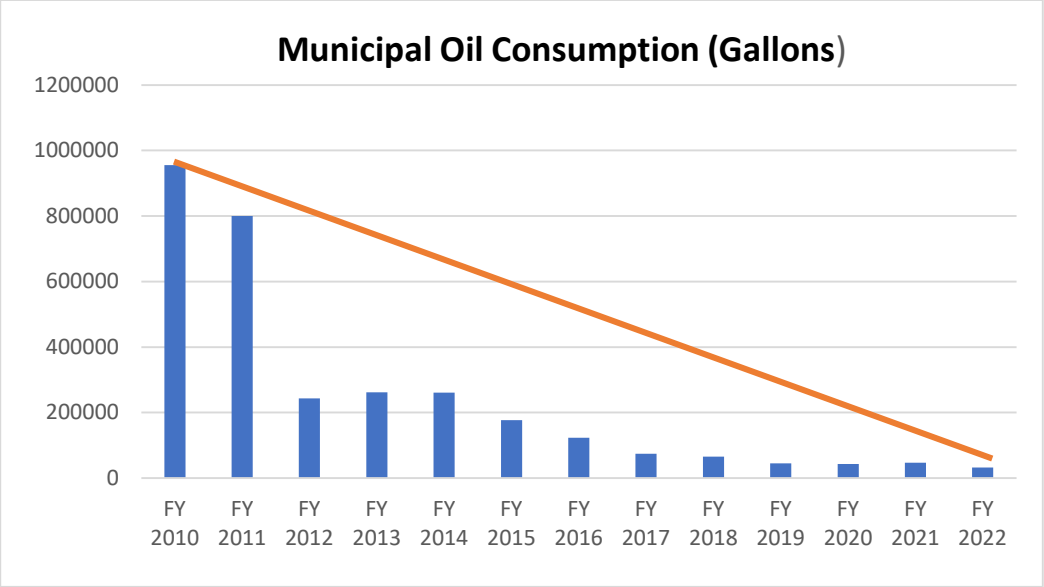


Figure 5: City of Providence's fuel oil consumption has declined by 99% since FY 2010 due to converting to natural gas systems.

Energy Supply: Renewables & Procurement Strategy

The Department of Public Property and the Office of Sustainability continue to identify energy conservation measures to maximize its operating budget and combat increasing energy costs. Despite rising energy prices, the City has reduced its operating costs for energy by nearly 39% since FY 2010 (see Figure 6). However, the City's energy costs have been trending upward over the past five years, with an increase by 6% since FY 2018; we saw a parallel increase in electricity use between FY 2018 and FY 2022. Increasing energy costs in recent years may also be attributed to the price of natural gas and inflation.

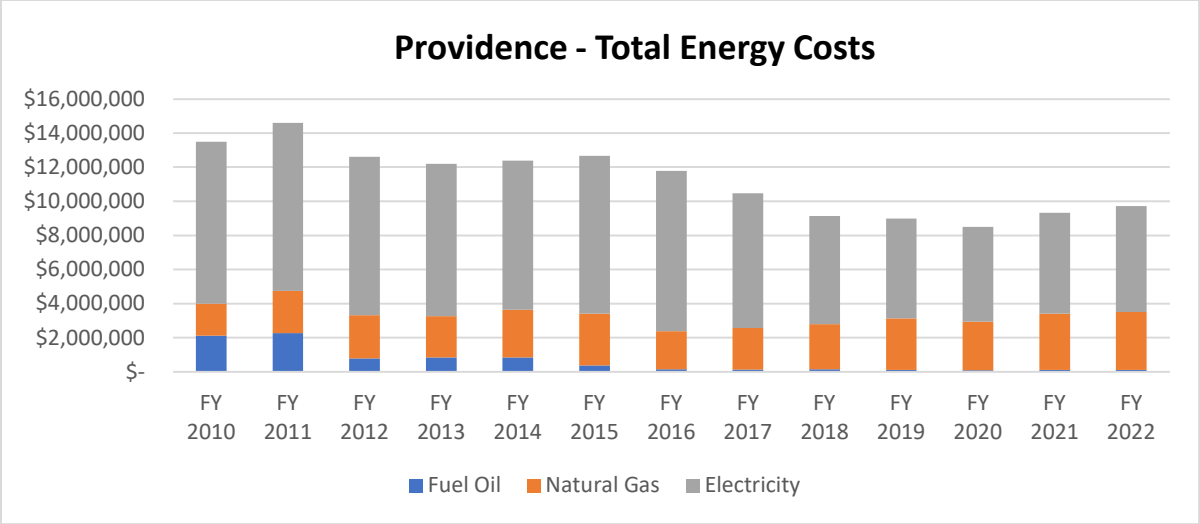


Figure 6: Despite rising energy costs, municipal spending on energy has decreased by 39% since 2010.

Energy procurement strategies have played a significant role in reducing the City's energy costs while also providing stability for budgeting. The City continues to work with a third-party energy supplier, Direct Energy, to secure long-term, fixed prices for its electricity supply. These contracts saved the City over $6 million compared to what it would have paid for electricity supplied by National Grid, now Rhode Island Energy between FY 2012 and FY 2022 (see Figure 7). Such contracts are enabled by the Energy Policy Act of 1992, which decoupled electricity distribution (retained by the utilities) from suppliers.

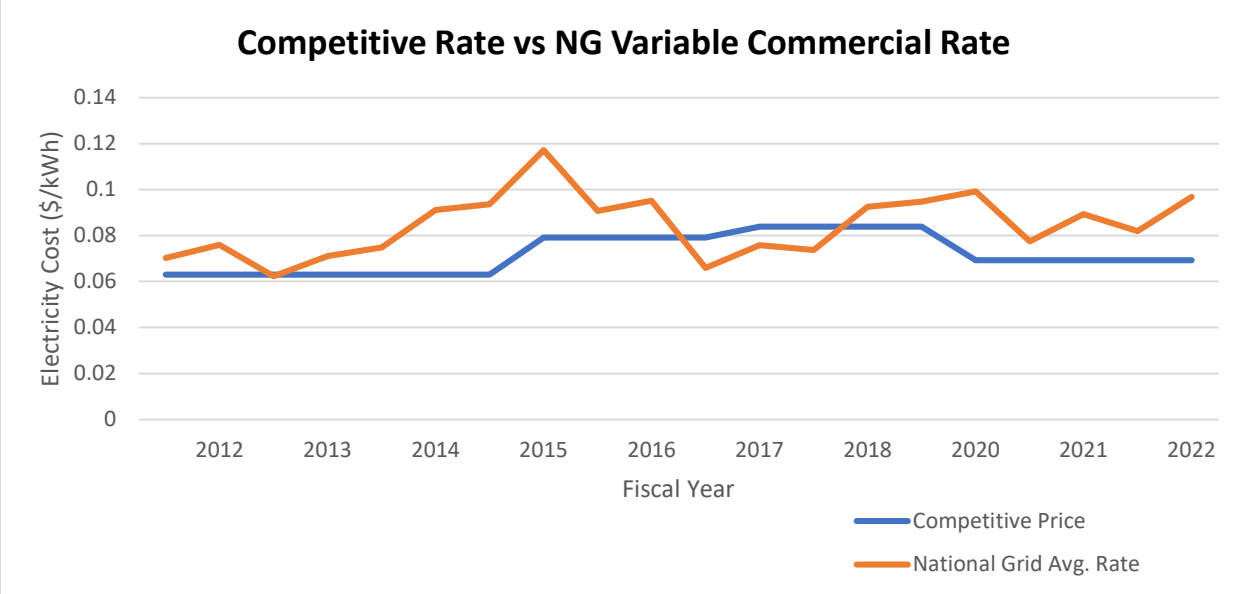


Figure 7: The graph provides a comparison of the City's actual electricity cost based on its third-party supplier rate versus estimated cost of National Grid's and Rhode Island Energy's average rate.

Solar Procurement - Virtual Net Metering

In April 2019, the City's 23 MW virtual net metering project came online. A small part of the system (3.9 MW) is located on a former landfill site in the Town of Johnston and the rest of the system is generated from a site in Cranston, RI. Energy from the photovoltaic array generates electricity equivalent to most of Providence's municipal electricity needs. The project was developed by Southern Sky Renewables and designed and built by Conti Solar and members of the International Brotherhood of Electrical Workers, IBEW Local 99. The 30.5-million-kilowatt hours per year of renewable energy produced by the nearly 58,000 panels (City consumes on average 35 million kWh) will eliminate 22,670 metric tons of carbon dioxide equivalent (CO_2e) from the atmosphere annually and will provide roughly $1.66 million in annual electricity savings to the City. After the first ten years of the contract, the City will be able to retain the Renewable Energy Credits (RECs), meaning the City can claim the carbon reduction benefits of the solar production.

Due to unforeseen circumstances, including the COVID-19 pandemic and the state takeover of the Providence Public Schools, the City of Providence has significant excess credits which it is currently working to monetize and more permanently apply to additional electric accounts. In FY 2022, the City solicited proposals and executed contracts with eight (8) offtakers for one-time transfers of approximately $3,000,000 in virtual net metering credits. While the transactions through the utility were slowed during the acquisition of National Grid by PPL and

transition to Rhode Island Energy, the utility is amenable to the continued transfers as needed. The City aims to reach an agreement to permanently share credits with an offtaker in order to better balance its VNM credit portfolio.

Building Portfolio

The City's Department of Public Property manages and maintains approximately 130 buildings totaling 5.4 million square feet of floor space. This includes 38 school buildings,[1] one central public safety complex, nine district police sub-stations, 13 fire stations (one of which is inactive[2]), eleven recreation centers[3], three maintenance buildings, 35 park buildings, one multi-level parking garage, one police academy training facility, and seven administration buildings. The schools' roughly 4.2 million square feet of space account for 79% of the City's portfolio (see Figure 8). Of the remaining 21% of building space (figure 9), public safety buildings account for 28% of building area. Buildings for public assembly such as The Casino at Roger Williams Park and those at the North Burial Ground account for 25%. Administration buildings or office space like City Hall account for 24%, the Department of Public Works accounts for 12%, and recreation centers account for 9% of municipal building area. The remaining two percent of properties include buildings such as the City's animal shelter and historic buildings including the Esek Hopkins House on Admiral Street and the Garvin House on Mashapaug Pond.

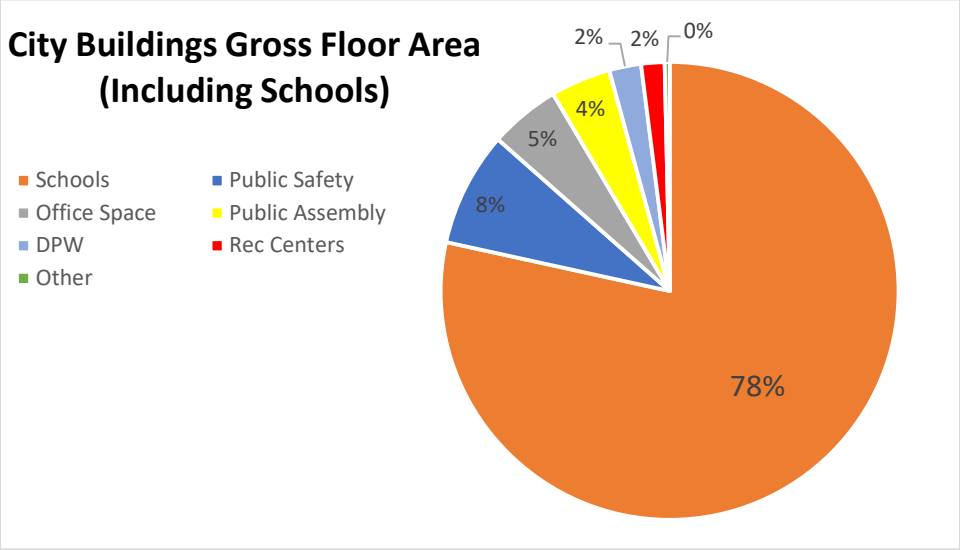


Figure 8: Total municipal building area percentage by facility type. Percentages based on building square footage.

[1] Some buildings house more than one school.
[2] Humboldt Fire Station closed in 2017 but still uses a base-line load of energy.
[3] Several of the City's schools double as neighborhood rec centers such as the B. Jae Clanton Educational Complex that serves as the John H. Rollins Rec Center, and Pleasant View Elementary School that now doubles as the new Armand E. Batastini Jr. Rec Center. Robert F. Kennedy and Sackett Street Elementary Schools also opened their new rec centers in 2017.

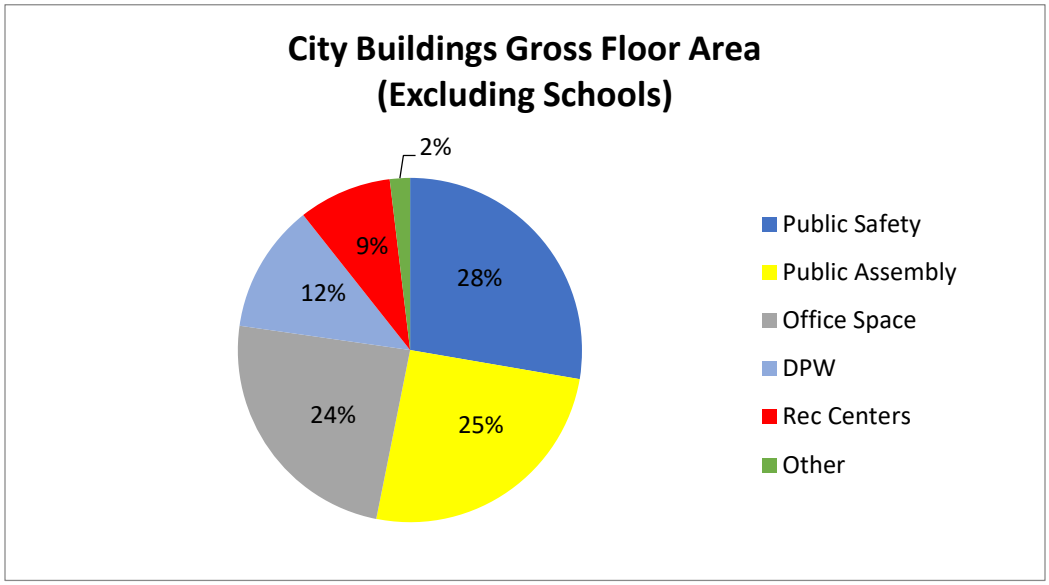


Figure 9: Municipal building area percentage by facility type. This chart excludes schools, which accounts for 79% of the building portfolio.

The buildings in the City's portfolio were constructed within a span of over one hundred and fifty years (see Figure 10). Built in 1855, Providence City Hall is one of the oldest. The newest City-owned building is the Providence Career and Technical Academy, built in 2009. The state-of-the-art technical education facility was built in conjunction with the Rhode Island Department of Education and their partners, the Collaborative for High Performance Schools. The latter provided guidelines on design and best construction practices for saving energy. Due to advancements in the Rhode Island State building codes and the passage of the Rhode Island Green Buildings Act (RIGL §37-24) in 2009, newer City-owned buildings have incorporated more advanced lighting, HVAC technologies and efficiency guidelines.

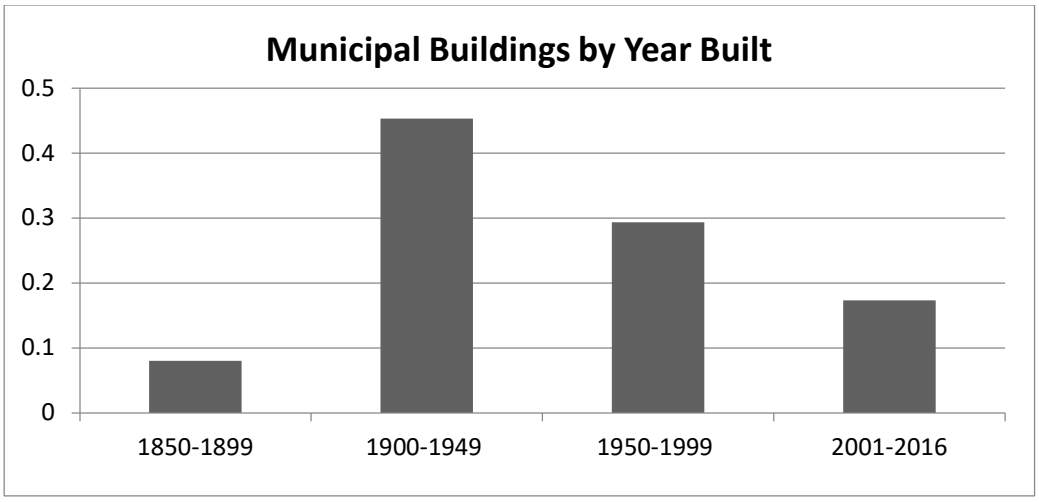


Figure 10: Municipal buildings by year built shown as a percentage. Most of the City's building portfolio was built in the early 20th century.

While it is often perceived that older buildings are less efficient, buildings constructed before the advent of HVAC systems and cheap, accessible energy were designed to be comfortable without these technologies. As a result, older buildings are often low consumers of energy when compared to more modern facilities. As you can see in Figure 11, buildings built in the mid-century are actually some of the least efficient buildings in our portfolio. These buildings were designed and constructed during a time when energy was cheap and building codes were not focused on energy efficiency measures.

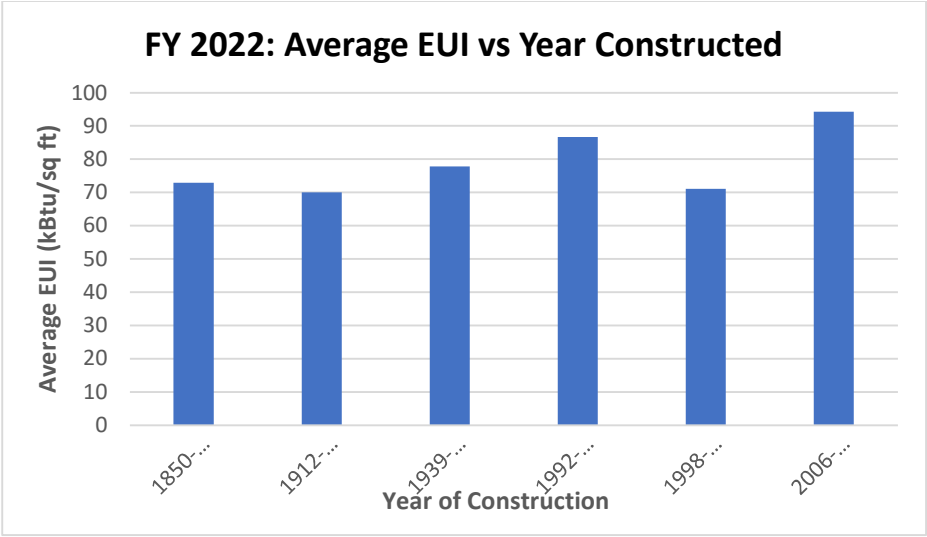


Figure 11: This graph compares year of construction with building's energy use intensity (EUI). Older municipal buildings, built before the advent of energy-intensive heating, cooling and lighting systems, are some of the City's lowest energy consumers per square foot. New policies such as the International building code of 1997 and energy policy act of 2005 have also influenced energy performance in modern buildings.

Identifying building use-types and age in this way helps in understanding the energy needs of the city's building portfolio. For instance, fire station garage doors are opened often during shifts, so the building may use more energy for heating and cooling compared to an office building of similar size. Fire and police stations are also generally occupied around-the-clock, unlike offices or recreation centers.

Benchmarking Buildings

Benchmarking allows for the review of a building's energy performance despite variables such as its size, age, type of use, level of occupancy, and weather. Benchmarking is a critical practice that enables the City to track building performance, identify opportunities for energy efficiency savings, and measure the effectiveness of energy efficiency measures. The City has benchmarked nearly 100 percent of all City-owned buildings. Only a small handful of buildings, including a number with no utility use, have been omitted. To benchmark its buildings, the City uses ENERGY STAR Portfolio Manager, a free online building benchmarking tool developed by the United States Environmental Protection Agency (EPA). It enables users to create building profiles by entering basic site information, such as year built and total square footage, and provides an ENERGY STAR score, which is a 1-100 standardized metric of energy efficiency.

ENERGY STAR Portfolio Manager uses utility billing data, along with details about the facility itself including gross floor area (sq. ft.), year built, and occupancy, to benchmark buildings against a national median of buildings with the same characteristics. The software also tracks how buildings perform over time. Users enter a minimum of one year's worth of energy bills for each fuel type. Portfolio Manager then calculates a building's Energy Use Intensity (EUI), a metric that represents the amount of Btu's (British thermal units) that a building uses per square feet. The higher the EUI, the more inefficient the building is. Portfolio Manager also calculates scores for buildings in certain categories, so that they can be recognized with **ENERGY STAR** certification. To score a building, Portfolio Manager takes the building's source energy use intensity (EUI) then uses a regression equation specific to each property type that reflects data from the US Energy Information Administration's (EIA) Commercial Building Energy Consumption Survey (CBECS) to calculate predicted EUI. The resulting actual/predicted EUI ratio is what determines the building's 1-100 **ENERGY STAR** score. Buildings with a score of 50 perform better than fifty percent of peer buildings, while buildings scoring 75 or above are in the top 75th percentile, making them eligible for **ENERGY STAR** certification.

An ENERGY STAR score is dependent on a nationally representative data set and robust analysis. Because of this technical foundation, many of the City's municipal buildings, such as fire stations, recreation centers, and service buildings cannot be benchmarked with an ENERGY STAR score. Alternatively, these buildings are benchmarked based on

site EUI. The Site EUI (Energy Use Intensity) for each building allows the Office of Sustainability to draw comparisons to that of other City municipal buildings of a similar type. As in previous annual reports, the FY 2022 Municipal Energy Report includes weather-normalized site EUIs. This metric allows the City to track energy use intensity in a way that accounts for annual variations in weather and allows for apples-to-apples comparisons between years. This helps the City benchmark buildings that cannot get Portfolio Manager scores.[4]

In August of 2018, the EPA updated its scoring models to reflect 2012 Commercial Buildings Energy Consumption Survey (CBECS) data supplied by the U.S. Energy Information Administration. The new data, published in 2016, is a 29% larger sampling, with a 14% increase in the total number of buildings, and a 22% increase in total building floor space. The City uses the updated scoring model for its data and has applied the model to historical data as well to maintain the ability to compare performance over time.

Strategic Energy Management

In 2017, an outside team of consultants funded by the U.S. Department of Energy engaged with the City of Providence to develop a strategic approach to energy management. The team, which included New Buildings Institute (NBI), Eco Edge and Maalka, embraces a data-driven approach to conserving energy as well as a people-oriented process.

Using the City's extensive data relating to energy use, the consultant used specialized software to analyze energy usage trends for all feasible municipal buildings. Buildings were then prioritized for more in-depth facility assessments based on relative energy use, total energy consumption, and peer building comparisons. The methodology also allowed the consultant to identify which type of improvements would be most beneficial on a building-by-building basis (e.g., heating, thermal baseload or electric baseload).

Many of the objectives, targets and strategies in the Climate Justice Plan are derived from the findings of this study, including the benefits of electrifying the heating sector and retrofitting outdated building electronic appliances. With the long-term goals:

- 100% of municipal buildings' electricity will be renewable by 2030.
- 100% of municipal buildings' heating will be renewable by 2040.

[4] Although Portfolio Manager is capable of measuring energy use for all types of buildings, some building types are not eligible for scoring such as public safety buildings, DPW buildings and rec centers. The Providence Career and Technical Academy, unlike other City schools, is also not eligible to receive an ENERGY STAR score.

The Office of Sustainability is using Peregrine Focus to analyze energy data to identify good and poor performing buildings on a monthly or annual basis. The department is then able track improvements and return on investment for specific projects.

Municipal School Buildings

The City of Providence has 42 K-12 schools operating in 38 municipal school buildings. The buildings are owned by the City, and maintained by Aramark, a facilities management contractor, with oversight by the Providence Schools Department and the City's Department of Public Property. Some buildings house more than one school, such as the Charles N. Fortes and Alfred Lima, Sr. Elementary Schools, which are housed in different wings of The Leviton Complex building.

Representing most of the City's building space, and with a student, teacher, and staff population of nearly 24,000, City schools account for most of Providence's municipal energy use. In FY 2022, Providence's schools used 273,962.72 MMBtu of energy (see figure 12). This accounted for 68% of the City's energy consumption. After seeing a substantial drop in 2016, the energy used by the City's school buildings has slightly trended up over the last few years, coinciding with an up-tick in after-school and summer programs that began being offered by the City in FY 2017, including Mayor Elorza's Summer Learning Programs and Summer Day Camp.

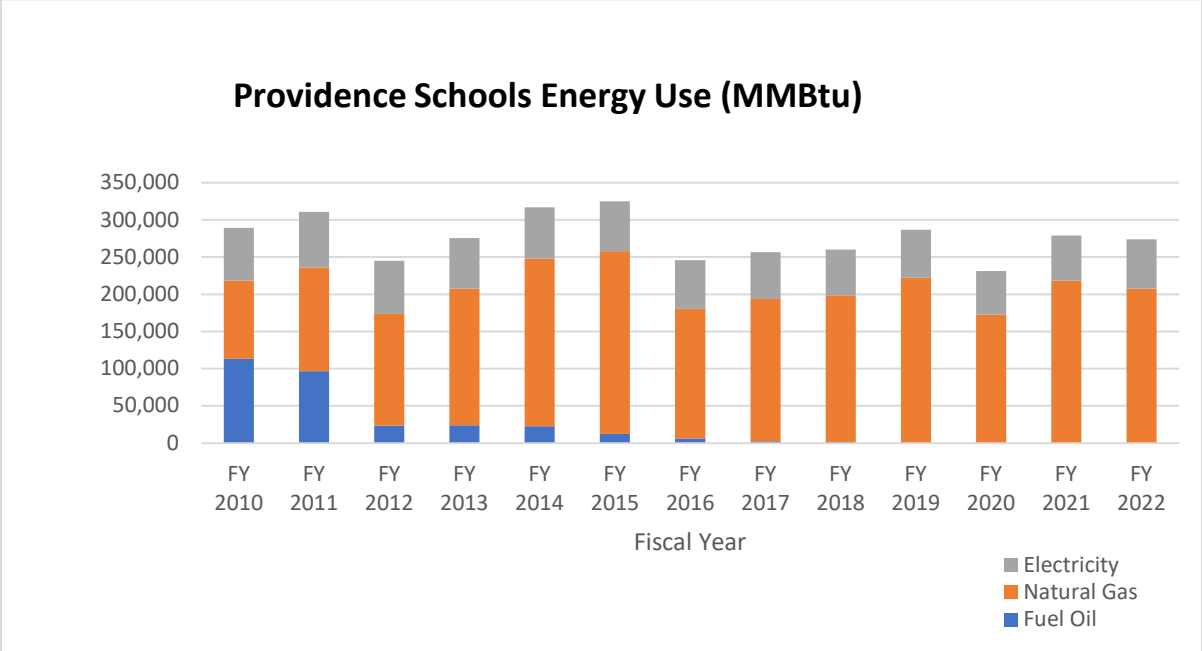


Figure 12: In FY 2022, Providence Schools' electricity, natural gas, and fuel oil consumption was down 16% from an eight-year high of 325,179 MMBtu in FY 2015.

While there are many unavoidable factors that can impact energy use in schools (i.e. extended hours of use, increased use of electronics, and increasing student and teacher population), the City continues to make on-going investments in energy efficiency. The reductions have been largely driven by HVAC upgrades, controls retro-commissioning and building weatherization completed by Aramark and the Department of Public Property. Under the direction of the Department of Public Property, Aramark monitors and maintains all of the equipment associated with heating and cooling the school buildings. They also are an important partner in coordinating energy efficiency projects in the City's schools and working with National Grid, now Rhode Island Energy, to leverage financial incentives from the utility. For example, in 2016, this strategy resulted in weather-stripping replacement in school buildings district-wide, a project that netted $42,148 in National Grid incentives and is projected to reduce the district's natural gas use by 32,074 therms and save about $45,000 a year. Aramark's HVAC control technicians have implemented building management systems (BMS) at schools' district-wide, in addition to fine tuning boilers and controls.

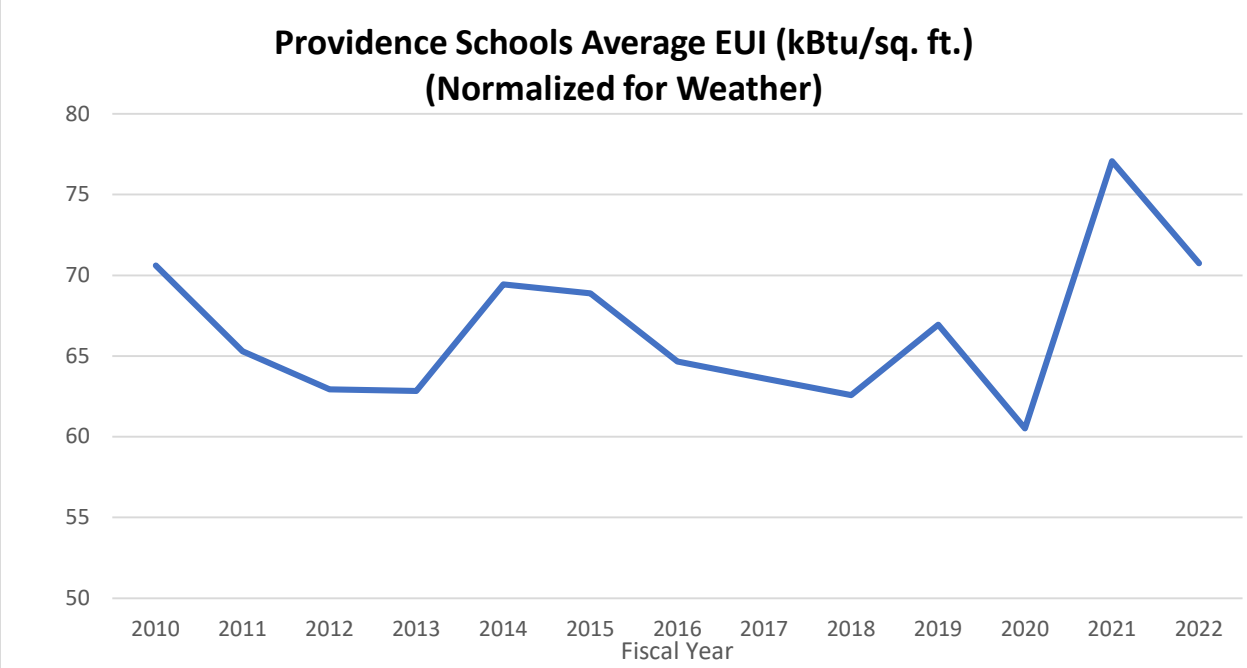


Figure 12b: Weather-normalized average energy use intensity (EUI) for all City school buildings. FY 2021 saw a dramatic spike in EUI. While FY2022 declined from this peak, the average EUI still exceeds all previous values since FY2010.

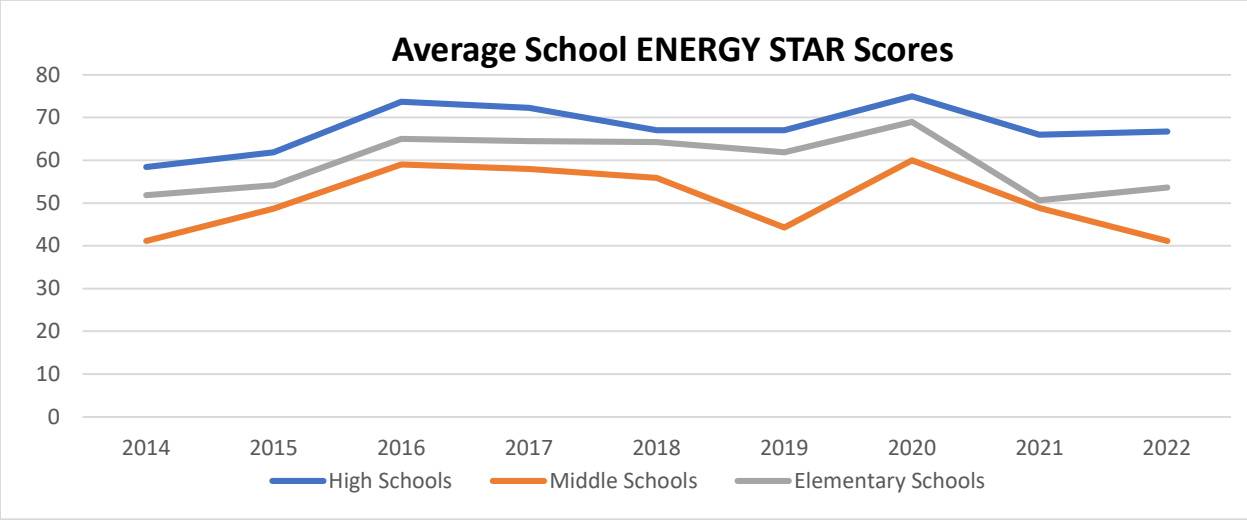


Figure 13: Though some middle school ENERGY STAR scores dipped in 2022, average scores for all school buildings have increased since 2014. The dramatic spike in EUI in recent years has resulted in lower average energy scores.

While much of the work for maintaining and upgrading HVAC systems is included in Aramark's operating budget, large-scale projects depend on financing from the City, which relies heavily on Rhode Island Department of Education (RIDE) School Building Authority (SBA) school housing aid reimbursements and the SBA Capital Fund. To qualify for the funding, projects need to comply with all current Northeast Collaborative for High Performance Schools Protocol (Northeast-CHPS) requirements "so that approved projects provide high quality learning environments, conserve natural resources, consume less energy, are easier to maintain, and provide an enhanced school facility".[5] Large-scale projects are normally included in Providence Schools' master plan, which is updated every five years. Some recommendations for the master plan come from the SBA, who provides facility condition assessments to the City so it can effectively use its limited resources to provide the best outcomes. Data collected during the facility condition assessments are the basis for the SBA Recommended Action Plan that provides guidance during the master planning process. The facility condition assessments contain "detailed information associated with each building component, including the overall condition of school facilities, as well as life cycle forecasting information that attempts to identify future building and system needs."[6]

[5] RIDE School Construction Regulations (5/24/07)
[6]http://www.ride.ri.gov/FundingFinance/SchoolBuildingAuthority/FacilityDataInformation.aspx#37541392-condition-assessments

Elementary Schools

In FY 2022, Providence Public Elementary Schools on average saw a slight increase in ENERGY STAR scores within each property. In comparison to the average ENERGY STAR Scores in FY 2021, Elementary Schools increased by 5%. Only three Elementary Schools managed to qualify for ENERGY STAR Certification by scoring higher than 75, staying the same as last year. The total number of all ENERGY STAR Certified PPSD schools went from 9 in FY 2021 to 5 in FY 2022. Robert L. Bailey, IV Elementary School scored 85 which was the highest ENERGY STAR score of all the City's schools in FY 2022 (88 in 2021). Two other schools' worth noting are Leviton Dual Language School and B. Jae Clanton Complex for both being able to drop their Energy Use Intensity (EUI) to under 50 kBtu/ft2, coinciding with an increase of 10 points in their ENERGY STAR score. While the current data clearly shows that newer buildings performed much better than older buildings, it also demonstrates that older schools are capable of achieving high scores. Using EUI as a measurement, the top 4 performing elementary school buildings were constructed after 1999. However, Frank D. Spaziano elementary school was constructed in 1895, yet was eligible for ENERGY STAR Certification in FY 2021 with a score of 76. As part of recent capital improvements Spaziano is undergoing additional renovations and was inactive in FY 2022.

Energy Efficiency Improvements

Working closely with Gilbane, Aramark and National Grid, now Rhode Island Energy, the City has implemented numerous energy efficiency measures throughout the City's elementary schools including heating and cooling systems, building management systems (BMS), lighting upgrades, and building envelope improvements.

Building Management System Upgrades

In FY 2022, Aramark continued its ongoing maintenance and monitoring of Building Management Systems (BMS) district-wide.

Heating and Cooling System Upgrades

HVAC and BMS upgrades in the gym and swimming pool area at Pleasant View Elementary School/Armand E. Batastini Jr. Rec Center have conserved over 18,000 therms of natural gas and prevented 64 metric tons of CO_2e from entering the atmosphere between FY 2016 and FY 2020. The building's two main boilers have been replaced with condensing boilers, and a 750-gallon hot water storage tank was replaced with a 200-gallon tank. Since the building's construction in 1971, the main boiler was responsible for heating the pool, which resulted in the need to run the boiler during warmer, shoulder months. As of FY 2016, a separate boiler heats the pool and saved the school district more than $20,000 between FY 2016 and FY 2020.

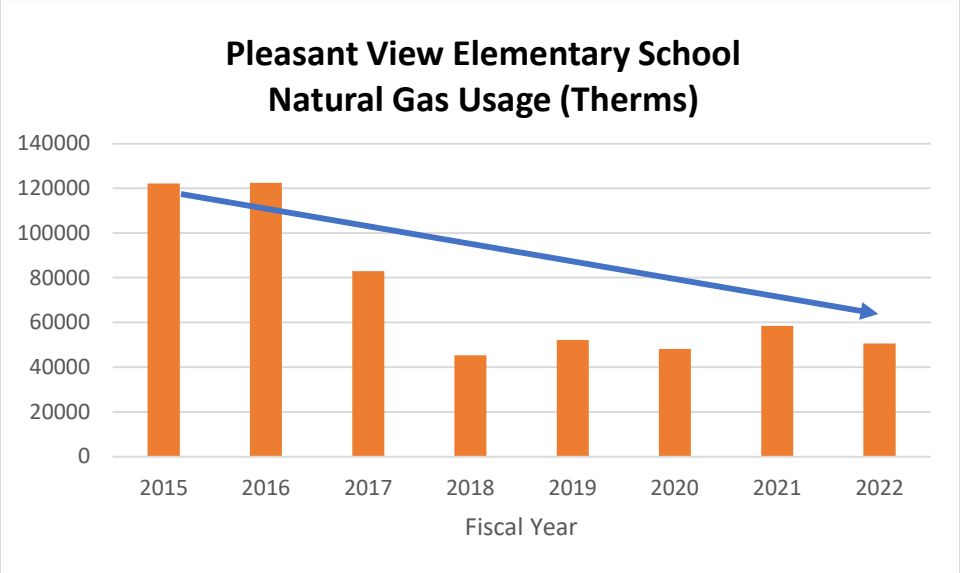


Figure 14: The evolution of heating system upgrades at Pleasant View is reflected in the building's natural gas use.

Regular maintenance of heating system steam traps is essential to preventing leaks that can waste thousands of dollars each year. Through incentives from National Grid, now Rhode Island Energy, the City receives $3 for every therm saved, up to 50% of the repair costs. The City is also reimbursed for 100% of the cost of the steam trap surveys needed to identify traps in need of repair. Large buildings with steam heat can have hundreds of steam traps, such as Mount Pleasant High School, which has 602 steam traps located throughout the school. Other schools where traps are regularly surveyed and maintained include Hope High School, Nathanael Greene, Gilbert Stuart, and Roger Williams Middle Schools. The Harry Kizirian, Robert F. Kennedy, Carl G. Lauro, Mary E. Fogarty, George J. West, and Allan Shawn Feinstein Elementary Schools also have their steam traps regularly maintained through the National Grid, now Rhode Island Energy program. Together, these projects are helping save about 300,000 therms of natural gas annually and are keeping about 1,591 metric tons of CO_{2e} from entering the atmosphere every year.

In FY 2019, there were a number of heating and cooling system projects that were completed in Providence elementary schools. Harry Kizirian Elementary underwent unit heater replacement and improvements. Alan Shawn Feinstein installed Cozy® thermostatic steam radiator covers, and Steam trap repairs. Lastly, Vartan Gregorian and Veazie Elementary schools had their roofs repaired, which significantly improved the building envelope and overall heating and cooling efficiency at the sites.

LED Lighting Retrofits

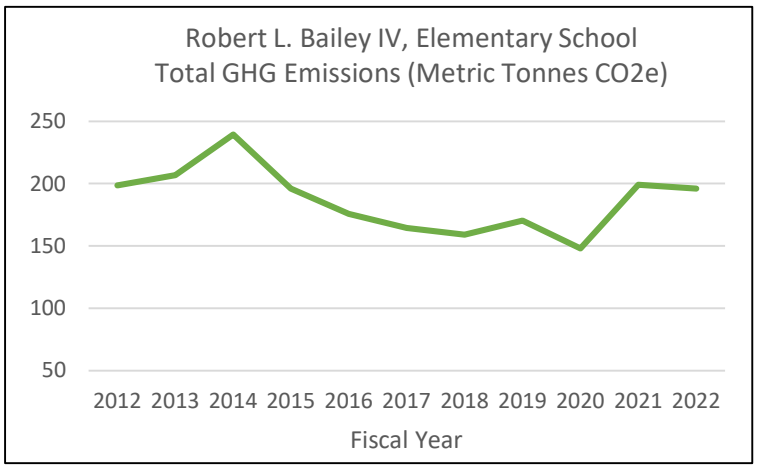
As of 2020, ten out of 22 elementary schools had been retrofitted with new interior LED lighting. Despite increased activity at the City's elementary schools, both before and after school, the school district saved approximately 2.7 million kWh of electricity across the 10 schools in FY2020, saving about $450,000 thousand at retrofitted schools between FY 2017 and FY 2020. The long lifespan of the new LED lamps (up to 70,000 hours) also significantly reduces maintenance costs compared to prior conditions.

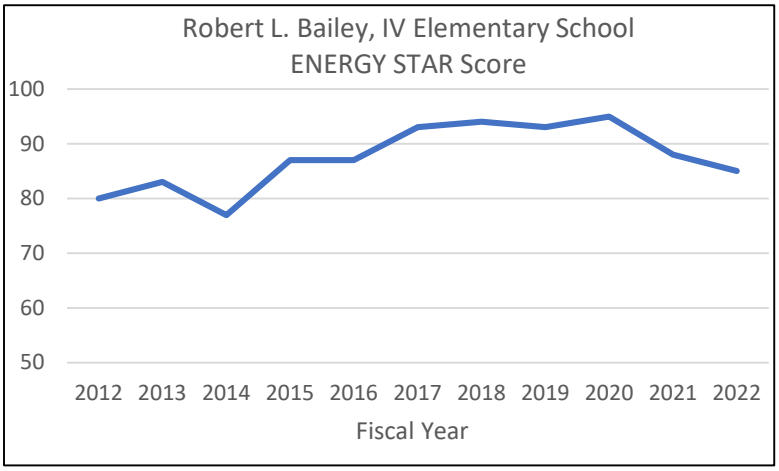
Property Information			FY 2022 Fuel Consumption				Energy Use Intensity			ENERGY STAR Score			Green House Gas Emissions		
Property Name	Property GFA - Self-Reported (ft^2)	Year Built	FY 2022 Electricity Use - Grid Purchase (kWh)	FY 2022 Natural Gas Use (therms)	FY 2022 Fuel Oil #2 Use (kBtu)	Site Energy Use (kBtu)	FY 2010 Weather Normalized Site EUI ($kBtu/ft^2$)	FY 2022 Weather Normalized Site EUI ($kBtu/ft^2$)	Percentage Improvement	FY 2010 ENERGY STAR Score	FY 2022 ENERGY STAR Score	Percentage Improvement	FY 2010 Direct GHG Emissions (Metric Tons CO2e)	FY 2022 Direct GHG Emissions (Metric Tons CO2e)	Percentage Improvement
Elementary Schools							***70***	***71***	***-2%***	***53***	***54***	***1%***	***257***	***204***	***21%***
Allan Shawn Feinstein Elementary School @ Broad Stre	77,899	1895	146,290	61,433	NA	6,642,437	74.9	93.9	-25%	80	64	-20%	375.5	326.3	13%
Anthony Carnevale Elementary School	78,000	1999	424,450	17,536	NA	3,201,778	56.7	43.9	23%	47	75	60%	113.4	93.1	18%
Asa Messer Elementary School @ Samuel W. Bridgham	109,255	1972	523,507	46,903	NA	6,476,453	70.8	64.4	9%	39	48	23%	395.7	249.1	37%
B. Jae Clanton Complex	103,000	2004	525,133	30,550	NA	4,846,768	89.4	51.1	43%	41	81	98%	352.9	162.3	54%
Carl G. Lauro Elementary School	117,482	1921	296,831	74,736	NA	8,486,411	62.6	80.3	-28%	71	48	-32%	311.8	397	-27%
Dr. Martin Luther King Elementary School	71,724	1959	244,224	32,537	NA	4,086,953	59.4	61.3	-3%	71	73	3%	234.3	172.8	26%
Frank D. Spaziano Elementary School	58,015	1908	117,093	30,573	NA	3,456,779	73.0	66.7	9%	56	65	16%	256.2	162.4	37%
George J. West Elementary School	112,030	1959	270,191	81,421	NA	9,064,020	70.2	90.2	-28%	64	39	-39%	488	432.5	11%
Harry Kizirian Elementary School	73,950	1959	259,163	45,448	NA	5,429,103	68.4	80.6	-18%	57	41	-28%	279.8	241.4	14%
Leviton Dual Language School	40,000	2002	282,684	8,366	NA	1,801,080	49.6	47.8	4%	73	73	0%	52.7	44.4	16%
Lillian Feinstein Elementary School @ Sackett Street	68,400	1921	269,680	30,925	NA	4,012,642	58.5	65.1	-11%	71	69	-3%	190.6	164.3	14%
Mary E. Fogarty Elementary School	51,400	1959	171,668	27,370	NA	3,322,682	64.6	71.0	-10%	60	50	-17%	180.5	145.4	19%
Pleasant View Elementary School	74,800	1971	513,819	50,559	NA	6,809,066	22.3	98.0	-339%	NA	29	NA	NA	268.5	NA
Reservoir Avenue Elementary School	22,000	1924	126,281	12,506	NA	1,681,504	81.7	84.4	-3%	28	17	-39%	72.3	66.4	8%
Robert F. Kennedy Elementary School	49,840	1921	158,080	44,391	NA	4,978,441	84.6	110.7	-31%	38	19	-50%	279.6	235.8	16%
Robert. L Bailey, IV Elementary School	78,000	2000	391,540	19,086	NA	3,244,526	46.7	44.8	4%	79	85	8%	99.9	101.4	-2%
The Leviton Complex	178,654	1908	1,065,474	55,558	NA	9,191,186	56.6	53.7	5%	52	48	-8%	331.9	295.1	11%
Vartan Gregorian Elementary School	63,000	1954	269,720	38,553	NA	4,775,590	108.6	84.9	22%	16	32	100%	280.7	204.8	27%
Veazie Street Elementary School	110,000	1909	412,587	45,022	NA	5,909,946	90.2	58.8	35%	31	60	94%	410	239.1	42%
Webster Avenue Elementary School	44,290	1904	145,621	21,017	NA	2,598,559	56.8	65.2	-15%	65	57	-12%	151.6	111.6	26%
William D'Abate Elementary School	44,174	1959	NA	33,312	NA	NA	115.3	NA	NA	25	NA	NA	286.5	176.9	38%
Fuel oil is no longer used in this group of buildings.															

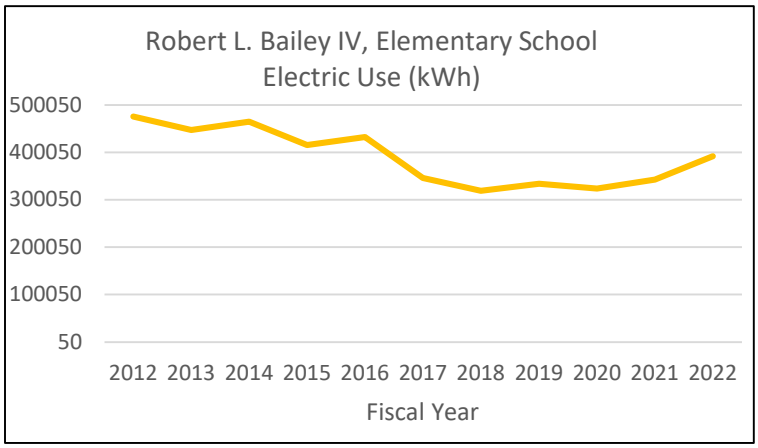
In FY 2022, the Department of Sustainability and Providence Public Schools worked with the Office of Energy Resources to leverage utility incentives for the next phase of LED lighting upgrades at three Providence school buildings, including Lima and Fortes schools at Leviton Complex. The sourcing and installation of lighting fixtures and lighting controls throughout the schools – in classrooms, hallways, gyms, cafeterias, office areas, and other spaces – was underway in FY 2022. The total expected savings on electricity and maintenance at the Lima and Fortes schools is approximately $45,000 annually.

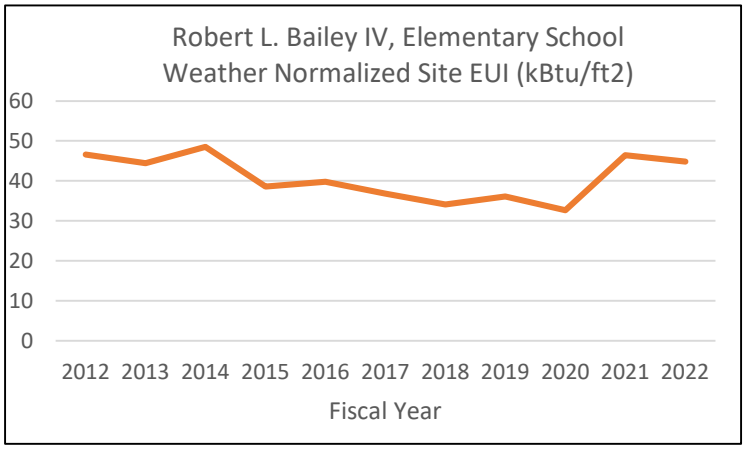
Highlight: Robert L. Bailey, IV Elementary School

In 2019, investments in energy efficiency measures at the Robert L. Bailey Elementary School, including weather-stripping, LED retrofitting and Building Management System (BMS) upgrades, have all contributed to the building's ENERGY STAR score improvement, lower electricity use, and lower EUI. Carbon emissions at the site are below FY 2010 levels.









Middle Schools

Five of the City's six middle school buildings are among the oldest buildings in the City's portfolio. Constructed in 1916, Esek Hopkins is the City's oldest middle school, but thanks to energy efficiency improvements such as HVAC control upgrades, steam trap replacements, and LED lighting upgrades, the building had maintained its ENERGY STAR Certification (score of at least 75) between FY 2015 and FY 2021. This changed in FY 2022, with Esek Hopkins' ENERGY STAR Score dipping to 71, below the required 75.

In fact, in FY 2022, no middle schools were able to achieve ENERGY STAR certification, representing one of the lowest performing years to date. Figure 13: Average Energy Scores demonstrates that on average Middle School ENERGY STAR scores have been on a steady decline, with the majority even dipping below baseline 2010 ENERGY STAR scores. Gilbert Stuart Middle School was the only building to increase ENERGY STAR scores from FY 2021 to FY 2022, from 52 to 53.

Energy Efficiency Improvements

Building Management System Upgrades

A new BMS at Governor Christopher Del Sesto Middle School was installed in 2017 which helped the building continue to perform well in FY 2022. Aramark continued its on-going maintenance and monitoring of all middle school BMS. However, increases in energy intensity metrics in recent years has raised questions regarding the effectiveness of these building management systems, particularly during the pandemic when usage patterns changed. Further investigation of BMS systems and patterns of use are required, with Aramark.

Heating and Cooling System Upgrades

A new #1 boiler and vacuum condensate receiver were installed in 2018 at the Nathanael Greene Middle School. Despite the enhanced heating efficiency of the new boiler compared to the older model, overall EUI at the site has increased substantially in recent years. Further study and intervention are required to determine the root cause of this performance decrease and potential remedies. Condensate is the liquid formed when steam passes from the vapor to the liquid state. A vacuum condensate receiver recovers the water and residual heat contained in the discharged condensate for the purposes of reusing it for the boiler. Recovering condensate, instead of discharging it completely, can lead to significant savings of energy. The City replaced the boilers at Gilbert Stuart Middle School and Roger Williams Middle School in 2016. At Gilbert Stuart, this upgrade included a new vacuum return system, and a properly-sized condensate tank to provide better efficiency.

LED Lighting Retrofits

LED lighting has been installed in all classrooms and common spaces at Esek Hopkins, Nathanael Greene, Roger Williams, Gilbert Stuart, and DelSesto middle schools. In 2016,

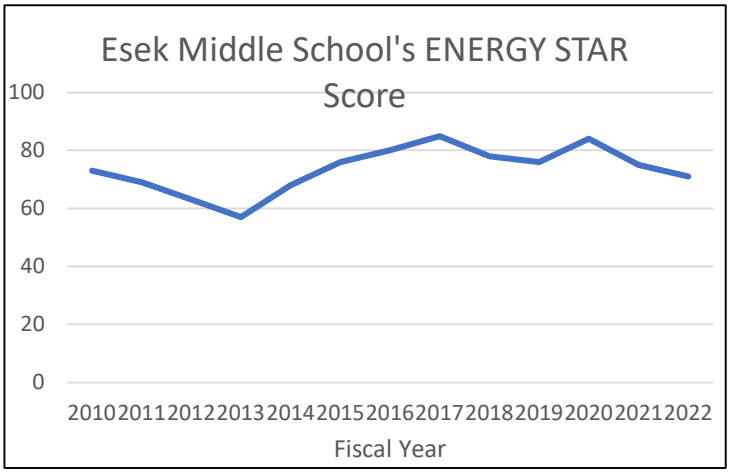
Aramark installed LED exterior lighting at Nathan Bishop, Nathanael Greene, and West Broadway, and, in 2017, replaced the 250-watt metal-halide lamps in the Nathanael Greene and Roger Williams Middle School auditoriums with 50-watt LED lamps. Between FY 2017 and FY2019 these LED retrofits have saved roughly over 1,124,840 kWh, and about $190,000. These savings have continued to accumulate through FY 2022.

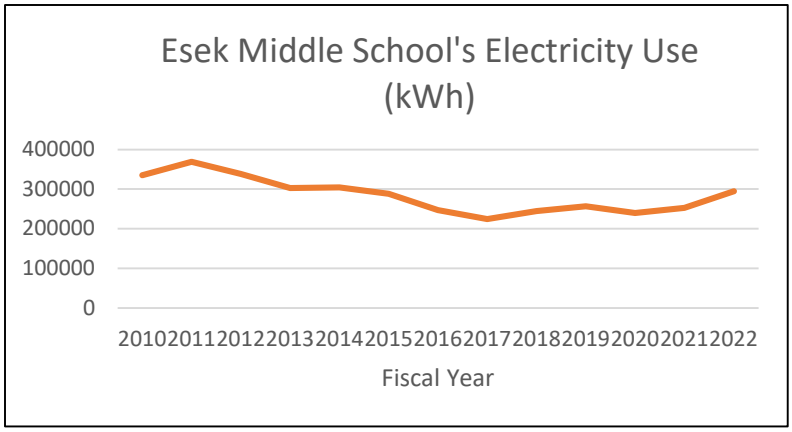
Property Information			FY 2022 Fuel Consumption				Energy Use Intensity			ENERGY STAR Score			Green House Gas Emissions		
Property Name	Property GFA - Self-Reported (ft²)	Year Built	FY 2022 Electricity Use - Grid Purchase (kWh)	FY 2022 Natural Gas Use (therms)	FY 2022 Fuel Oil #2 Use (kBtu)	Site Energy Use (kBtu)	FY 2010 Weather Normalized Site EUI (kBtu/ft²)	FY 2022 Weather Normalized Site EUI (kBtu/ft²)	Percentage Improvement	FY 2010 ENERGY STAR Score	FY 2022 ENERGY STAR Score	Percentage Improvement	FY 2010 Direct GHG Emissions (Metric Tons CO2e)	FY 2022 Direct GHG Emissions (Metric Tons CO2e)	Percentage Improvement
Middle Schools							***63.7***	***82.5***	***-30%***	***54***	***41***	***-23%***	***465***	***375***	***19%***
DelSesto Middle School	146,000	1998	907,933	39,644	NA	7,062,303	57	51.9	9%	52	63	21%	238.4	210.6	12%
Esek Hopkins Middle School	87,560	1916	294,768	32,402	NA	4,245,972	49.1	52.9	-8%	73	71	-3%	200.3	172.1	14%
Gilbert Stuart Middle School	154,450	1929	333,371	86,892	NA	9,826,631	56.1	70.9	-26%	70	53	-24%	502.8	461.5	8%
Nathan Bishop Middle School	136,000	1929	1,363,453	51,390	NA	9,791,083	68.9	76.4	-11%	50	23	-54%	NA	273	NA
Nathanael Greene Middle School	168,500	1930	267,621	141,600	NA	15,073,096	61.9	99.6	-61%	66	32	-52%	606.2	752.1	-24%
Roger Williams Middle School	135,228	1929	325,904	92,221	NA	10,334,041	89.1	84.5	5%	36	42	17%	778.7	489.8	37%
West Broadway Middle School	46,000	1966	257,975	49,642	NA	5,844,412	NA	141.5	NA	29	4	-86%	NA	263.7	NA

Fuel oil is no longer used in this group of buildings.

Highlight: Esek Hopkins Middle School

Esek Hopkins Middle School had maintained its ENERGY STAR Certification (score of at least 75) between FY 2015 and FY 2021. In addition to building-wide LED conversions and occupancy sensor installations, the school's BMS equipment has also been upgraded. Behavioral energy conservation efforts by students and staff had also played a major part in saving energy and reducing emissions at the site. However, in recent years, performance declined significantly, with Esek Hopkins' ENERGY STAR Score dipping to 71 in FY 2022, below the required 75. This decline in performance over the past two years demands further study and intervention to determine the root cause and potential remedies.





Property Information			FY 2022 Fuel Consumption				Energy Use Intensity			ENERGY STAR Score			Green House Gas Emissions		
Property Name	Property GFA - Self-Reported (ft²)	Year Built	FY 2022 Electricity Use - Grid Purchase (kWh)	FY 2022 Natural Gas Use (therms)	FY 2022 Fuel Oil #2 Use (kBtu)	Site Energy Use (kBtu)	FY 2010 Weather Normalized Site EUI (kBtu/ft²)	FY 2022 Weather Normalized Site EUI (kBtu/ft²)	Percentage Improvement	FY 2010 ENERGY STAR Score	FY 2022 ENERGY STAR Score	Percentage Improvement	FY 2010 Direct GHG Emissions (Metric Tons CO2e)	FY 2022 Direct GHG Emissions (Metric Tons CO2e)	Percentage Improvement
High Schools							***63***	***68***	***-7%***	***67***	***60***	***-10%***	***551***	***480***	***13%***
Central High - Classical High Schools	454,059	1962	2,249,120	161,128	NA	23,786,743	NA	57.1	NA	61	71	16%	1180.6	855.8	28%
Dr. Jorge Alvarez High School	88,000	2007	687,640	36,412	NA	5,987,470	55.6	72.4	-30%	61	47	-23%	130.3	193.4	-48%
E-Cubed Academy	44,600	2004	347,776	18,508	NA	3,037,389	52.8	73	-38%	67	58	-13%	45.8	98.3	-115%
Hope High School	257,089	1938	624,540	186,508	NA	20,781,716	73.1	90.6	-24%	76	66	-13%	781.6	990.6	-27%
Juanita Sanchez Educational Complex	110,000	2004	780,927	25,582	NA	5,222,750	69.6	50.5	27%	53	79	49%	206	135.9	34%
Mount Pleasant High School	320,000	1938	960,387	214,036	NA	24,680,453	74.9	85.2	-14%	75	66	-12%	1458.6	1136.8	22%
Providence Career and Technical Academy	300,000	2009	1,971,480	70,775	NA	13,804,154	NA	48.9	NA	NA	NA	NA	NA	375.9	NA
Windmill Annex (A Venture)	25,060	1930	109,457	10,708	NA	1,444,234	51.7	63.6	-23%	73	32	-56%	56.4	56.9	-1%

Fuel oil is no longer used in this group of buildings.

High Schools

The City owns nine high school buildings with some housing two or more schools. For example, the Juanita Sanchez Educational Complex (JSEC) houses William B. Cooley, Sr. High School and the Providence Academy of International Studies. Similarly, Mount Pleasant High School, also hosts 360, an "Opportunity by Design" high school.

Providence's high schools support a wide variety of academic, athletic, and cultural programs. Students, faculty and the community rely on the lighting, computers, and heating and cooling systems in these bustling activity centers during and after the normal school day.

Despite this, aggressive approaches by the City to improve energy efficiency in its high schools have resulted in two of the City's high school buildings, Juanita Sanchez Educational Complex (JSEC) and the Providence Career and Technical Academy (PCTA), achieving 50 or lower Weather Normalized Site EUI (kBtu/ft2) and ENERGY STAR Certification.

Note: Central and Classical High Schools share a common heating plant so are grouped together for the purpose of this report and ENERGY STAR scoring.

Energy Efficiency Improvements

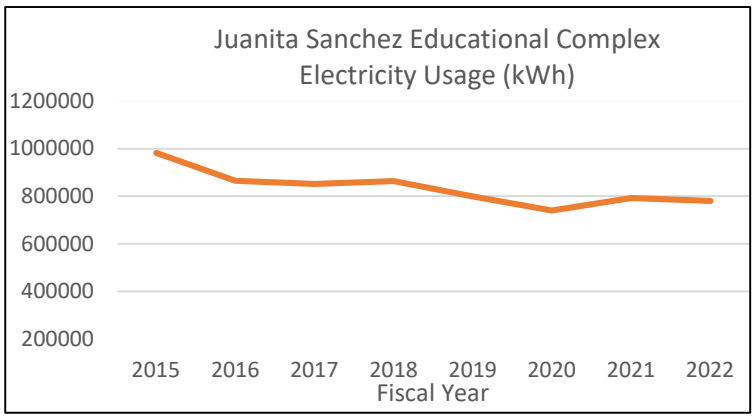
Heating and Cooling System Upgrades

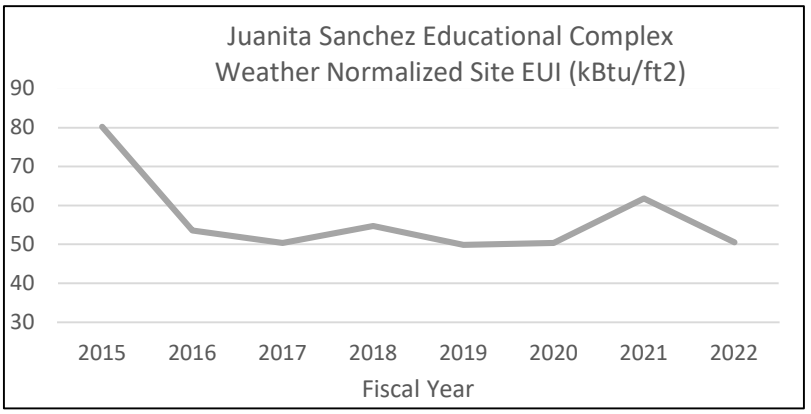
In 2017, the City leveraged utility rebates to help pay for two new condensing boilers at the Juanita Sanchez Educational Complex. The project also included a new BMS for the building's mechanical room that will monitor boilers, chiller, chiller pumps, and primary pumps. At the Classical Auditorium and Café, National Grid rebates also covered over 60% of the cost of a new building management system (BMS) and hot water pump variable frequency drives (VFDs). BMS systems at all of the high schools have continued to be maintained and monitored by Aramark, who performs repairs, upgrades, and recommissioning when needed.

In coming years, the Providence Schools master facilities plan includes the replacement of the boiler feedwater system at Hope High School and the replacement of roof top units (RTUs) at Central High School. While the driving factor behind both replacements is the antiquated and failing nature of the existing equipment, the projects will improve efiiciency and provide considerable maintenance cost savings.

Highlight: Juanita Sanchez Educational Complex

The Juanita Sanchez Educational Complex, home to the William B. Cooley, Sr. High School and The Providence Academy of International Studies, qualified for ENERGY STAR certification for the 3rd time in 4 years, by improving its score from a 74 in FY 2021 to

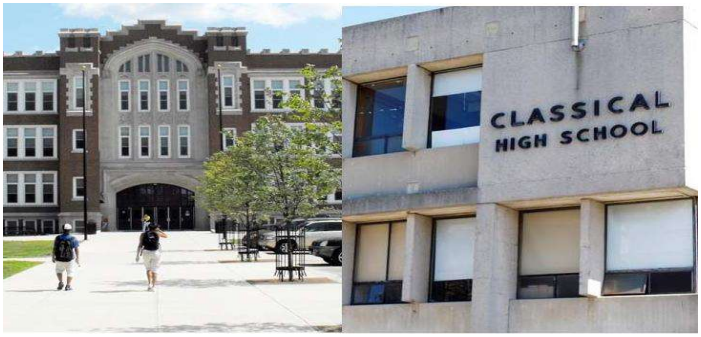




a 79 in FY 2022. The gymnasium roof was replaced in 2019 for a total project cost of $355,733.00. Boilers at the site were replaced with energy efficient condensing boilers in 2017, with a new energy management system and pump replacements. Energy efficient lighting upgrades through the building also began in FY 2022. Behavioral energy conservation efforts by students and staff have also played a major part in saving energy and reducing emissions at the site.

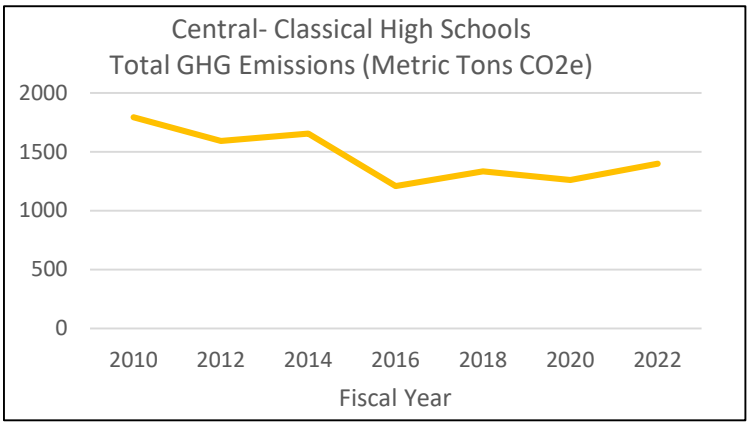
LED Lighting Retrofits

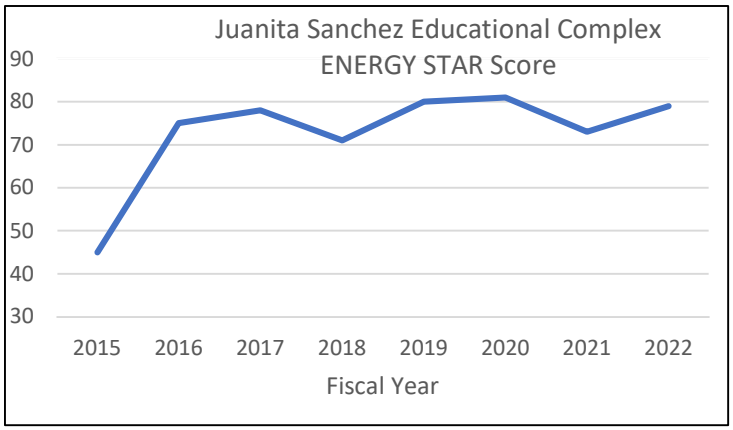
In FY 2022, the Department of Sustainability and Providence Public Schools worked with the Office of Energy Resources to leverage utility incentives for the next phase of LED lighting upgrades at three Providence school buildings, including Central High School and the Juanita Sanchez Educational Complex (JSEC). The sourcing and installation of lighting fixtures and lighting controls throughout the schools – in classrooms, hallways, gyms, cafeterias, office areas, and other spaces – was underway in FY 2022. The total expected savings on electricity and maintenance is over $50,000 at Central High School and over $50,000 at JSEC annually.

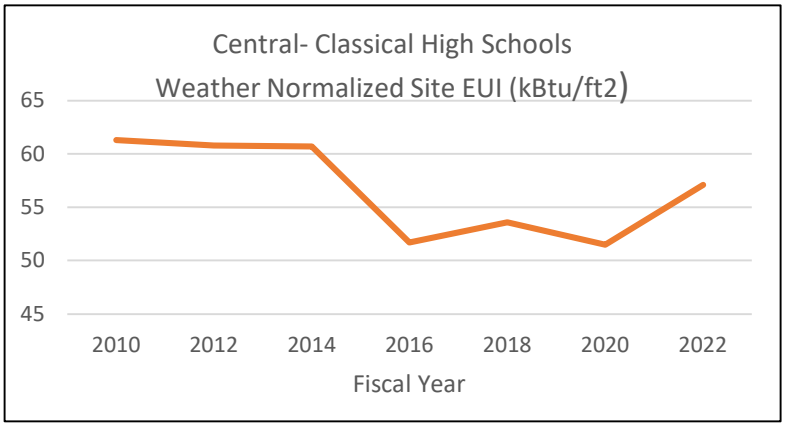


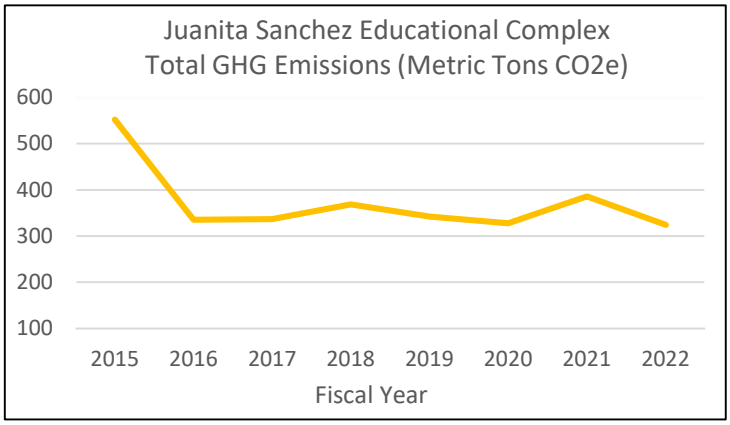
Highlight: Central and Classical High Schools

Central High School and Classical High School share an ENERGY STAR score because the buildings share a common heating plant. Since 2011, the city has retrofitted the buildings' boilers from #2 heating oil to natural gas (2011) completed LED lighting retrofits, installed hot water Variable Frequency Drives, replaced weather-stripping, and upgraded Building Management Systems. Energy efficient lighting upgrades at Central also began in FY 2022. Behavioral energy conservation efforts by students and staff have also played a major part in saving energy and reducing emissions at the site. However, in recent years, performance declined significantly. The schools' ENERGY STAR score continued a downward trend in FY 2022 and dropped below the threshold for ENERGY STAR Certification. This decline in performance over the past two years demands further study and intervention to determine the root cause and potential remedies.









Public Safety Facilities

Public Safety buildings present considerable energy efficiency challenges due to the intense nature of their use. The City's Public Safety Complex, which serves as headquarters and the central stations for the Providence Police and Fire Departments, and satellite fire stations are occupied twenty-four hours a day, seven days a week, 365 days a year by emergency responders. Though the Public Safety Complex uses more electricity than any other single building in the City's portfolio, energy use has been reduced at the site by 35% since FY 2010. Energy efficiency improvements include replacing the rooftop package unit for heating and cooling (2014), interior and exterior LED lighting upgrades (2014), and LED lighting retrofits to the main parking lot and parking garage (2017). In FY 2022, the City saved 1,607,803.00 kWhs of electricity at the Public Safety Complex and Garage in comparison to the FY 2010 baseline year. This cumulatively has saved 12,039,519.60 kWhs.

Energy Efficiency Improvements

Heating and Cooling System Upgrades

The Mount Pleasant Avenue, Hartford Avenue, Reservoir Avenue, and Messer Street Fire Stations were the latest buildings to be targeted for fuel switching and heating system upgrades. The measures, along with the measures at the Department of Telecommunications building (home to the City's 911 call center), were identified during energy efficiency audits by the Antares Group, courtesy of National Grid, to identify potential improvements for consideration in future funding opportunities.

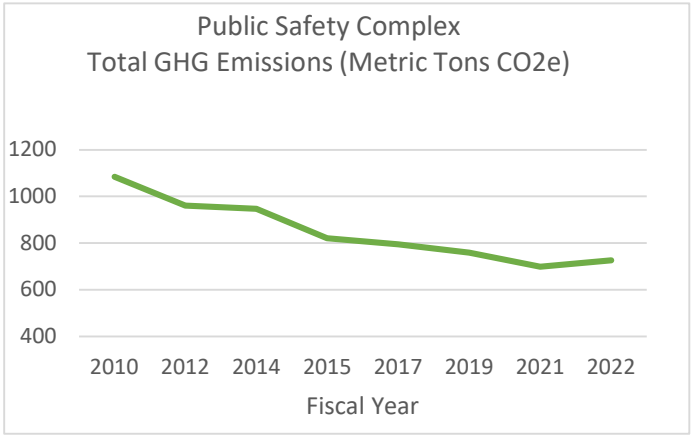
Property Information			FY 2022 Fuel Consumption				Energy Use Intensity			ENERGY STAR Score			Green House Gas Emissions		
Property Name	Property GFA - Self-Reported (ft^2)	Year Built	FY 2022 Electricity Use - Grid Purchase (kWh)	FY 2022 Natural Gas Use (therms)	FY 2022 Fuel Oil #2 Use (kBtu)	Site Energy Use (kBtu)	FY 2010 Weather Normalized Site EUI ($kBtu/ft^2$)	FY 2022 Weather Normalized Site EUI ($kBtu/ft^2$)	Percentage Improvement	FY 2010 ENERGY STAR Score	FY 2022 ENERGY STAR Score	Percentage Improvement	FY 2010 Direct GHG Emissions (Metric Tons CO2e)	FY 2022 Direct GHG Emissions (Metric Tons CO2e)	Percentage Improvement
Public Safety Complex							***108.1***	***107.0***	**1%**	***NA***	***NA***	***NA***	***52***	***72***	***-37%***
Department of Communications	13,608	1985	206,192	6,695	NA	1,372,974	157.5	106.7	32%	NA	NA	NA	40.8	35.6	13%
Peter A. Rochio Substation	914	2006	25,423	NA	NA	86,743	84.1	102.5	-22%	NA	NA	NA	NA	NA	NA
Providence Emergency Management Agency	12,776	1991	167,371	3,221	164,082	1,057,238	42.8	87.9	-105%	NA	NA	NA	15.3	29.3	-92%
Providence Police Academy	20,175	1928	12,780	16,914	NA	1,734,997	97.4	96.7	1%	NA	NA	NA	124.1	89.8	28%
Providence Water Authority Building	46,416	1960	159,667	31,923	NA	3,737,104	NA	88.8	NA	NA	NA	NA	NA	169.6	NA
Public Safety Complex	119,002	2002	2,585,006	19,049	NA	10,724,948	132.5	92.2	30%	NA	NA	NA	78.6	101.2	-29%
Steven M. Shaw District 5 Substation	546	1996	6,074	656	NA	86,355	134.2	174.3	-30%	NA	NA	NA	2.4	3.5	-46%

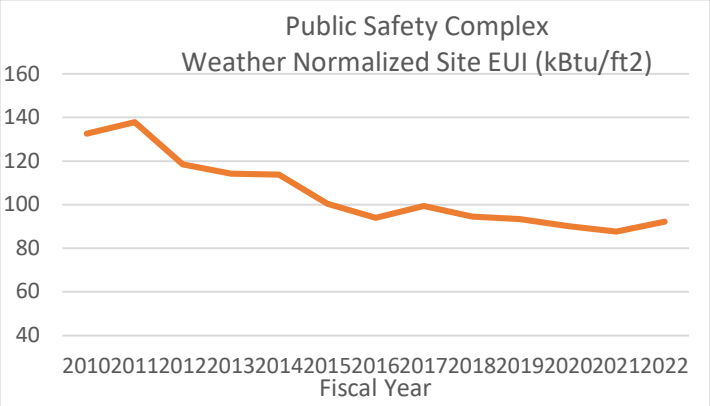
ENERGY STAR Scores are not available for this building type.

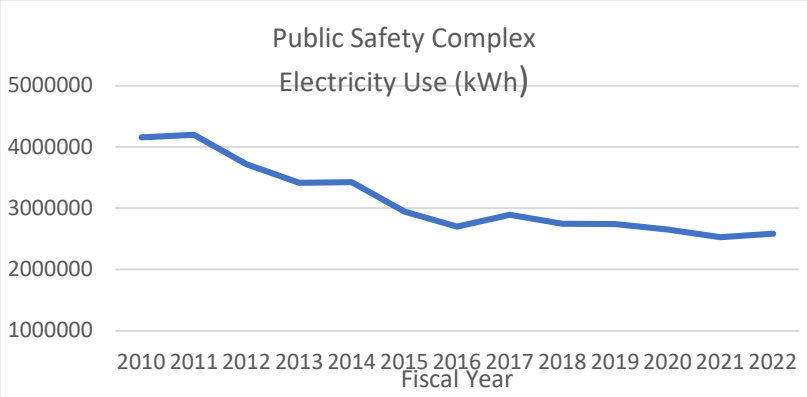
Property Information			FY 2022 Fuel Consumption				Energy Use Intensity			ENERGY STAR Score			Green House Gas Emissions		
Property Name	Property GFA - Self-Reported (ft²)	Year Built	FY 2022 Electricity Use - Grid Purchase (kWh)	FY 2022 Natural Gas Use (therms)	FY 2022 Fuel Oil #2 Use (kBtu)	Site Energy Use (kBtu)	FY 2010 Weather Normalized Site EUI (kBtu/ft²)	FY 2022 Weather Normalized Site EUI (kBtu/ft²)	Percentage Improvement	FY 2010 ENERGY STAR Score	FY 2022 ENERGY STAR Score	Percentage Improvement	FY 2010 Direct GHG Emissions (Metric Tons CO2e)	FY 2022 Direct GHG Emissions (Metric Tons CO2e)	Percentage Improvement
Fire Stations							***91.6***	***99.2***	***-8%***	***NA***	***NA***	***NA***	***49***	***40***	***17%***
Admiral Street Fire Station	12,850	1924	71,524	8,162	30,498	1,090,755	107.9	84.9	21%	NA	NA	NA	78.2	45.6	42%
Allens Avenue Fire Station	9,440	1948	56,122	5,579	NA	749,336	103.2	85.4	17%	NA	NA	NA	53.2	29.6	44%
Atwells Avenue Fire Station	10,022	1948	80,300	9,952	NA	1,269,202	80.8	135.7	-68%	NA	NA	NA	42.8	52.9	-24%
Branch Avenue Fire Station	14,616	1948	97,702	9,432	NA	1,276,548	78.0	93.8	-20%	NA	NA	NA	52.4	50.1	4%
Broad Street Fire Station	9,426	1942	73,330	7,051	NA	955,268	92.1	108.8	-18%	NA	NA	NA	45.1	37.4	17%
Brook Street Fire Station	7,580	1950	54,317	4,787	NA	664,040	90.4	93.5	-3%	NA	NA	NA	23.6	25.4	-8%
Hartford Avenue Fire Station	9,150	1948	63,933	388	536,958	793,933	88.9	92.5	-4%	NA	NA	NA	45.2	41.9	7%
Humboldt Avenue Fire Station	7,460	1905	23,511	NA	433,734	513,952	114.3	75.0	34%	NA	NA	NA	54.1	32.2	40%
Messer Street Fire Station	9,150	1948	65,474	565	450,570	730,428	80.1	84.1	-5%	NA	NA	NA	37.4	36.4	3%
Mount Pleasant Avenue Fire Station	5,332	1903	33,831	4,721	NA	587,550	126.8	121.2	4%	NA	NA	NA	35.1	25.1	28%
North Main Street Fire Station	14,760	1951	79,844	4,850	NA	757,441	65.5	55.1	16%	NA	NA	NA	46.9	25.8	45%
Reservoir Avenue Fire Station	7,360	1932	45,466	668	384,882	606,775	84.8	87.6	-3%	NA	NA	NA	29.5	32.1	-9%
Rochambeau Avenue Fire Station	7,400	1928	13,023	5,880	NA	632,455	126.3	96.2	24%	NA	NA	NA	38.6	31.2	19%
ENERGY STAR Scores are not available for this building type.															

Highlight: Providence Public Safety Complex

The Providence Public Safety Complex serves as the headquarters and central station for the Providence Police and Providence Fire Departments. As of FY 2022, Energy Use Intensity at the Public Safety Complex has declined by 34% since FY 2010. This meets and exceeds the goal outlined in the Sustainable Providence Plan, for 30% energy reduction in City-owned property by 2030. Emissions at the facility have also declined by 283.7 metric tons (28%) since 2010. Energy conservation efforts by first responders and support staff have also played a major part in saving energy and reducing emissions at the site.







Administrative Offices

Providence City Hall and the Joseph Doorley, Jr. Municipal Building[7] are the City's two primary administrative office buildings. The Mayor's Office, Public Property, Human Resources, Retirement Office, Tax Assessor, and the Office of Sustainability, are just a small sampling of the numerous City departments housed at Providence City Hall. The building, recognized in 2016 for having achieved an ENERGY STAR score of 94, continued to perform well in FY 2022, with a current score of 88. Providence City Hall is a great example of how energy efficiency retrofitting measures can reduce building emissions and provide energy and cost savings, even in a building constructed in 1878.

The Joseph Doorley, Jr. Municipal Building, named for Providence's thirty-first mayor, and leased from Paolino Properties, houses the City's Department of Inspections and Standards, and the Department of Planning and Development, along with several other City offices. In FY 2022 the building's annual weather-normalized energy use reduced by 18% since the baseline of FY 2010. However, in comparison to FY 2021, the building's performance declined significantly, a 25% increase in EUI. As one of Providence's larger energy consumers, the City continues to explore ways to enhance the building's energy efficiency performance as tenants of the space. A no-cost investment-grade energy audit was performed at the facility in 2016 that identified a number of investments that the City is considering to reduce operational costs of the building.

Other City buildings in this category include the Department of Recreation building, the Department of Public Works Administration Building, and Providence Schools' Dr. Robert F. Roberti Administration and Family and Community Engagement Center.

[7] The Joseph A. Doorley Municipal Building was first leased at the end of 2011, and therefore saw no energy used by the City in FY 2010.

LED Lighting Retrofits

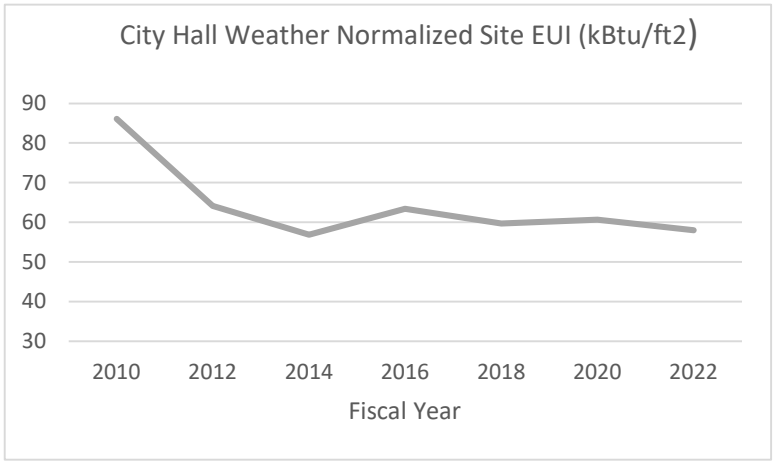
In the beginning of FY 2017, 22 exterior 400-watt metal halide flood lights illuminating Providence City Hall were replaced with 129-watt LED fixtures. This, in addition to the replacement of ten 500-watt halogen floodlights in the building's atrium, resulted in a 19% reduction in the building's electricity use between FY 2017 and FY 2018. These recent measures, combined with past LED tube retrofits in the building's offices, conference rooms and corridors have reduced annual electricity consumption at City Hall by 43% since FY 2010.

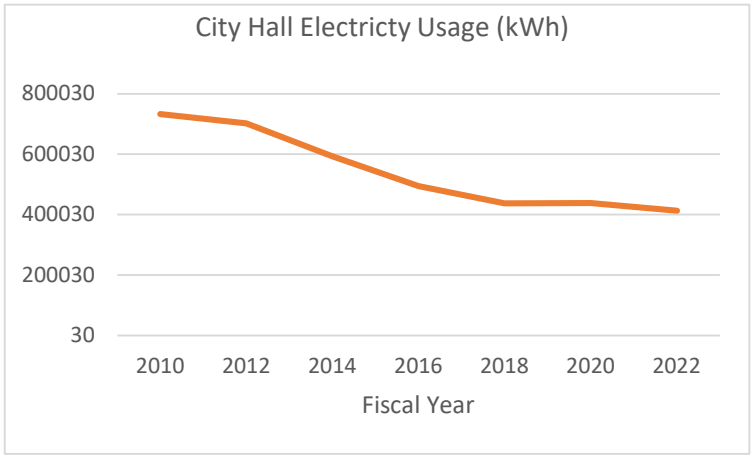
City Hall's consumed 724,400 kWhs of electricity in FY 2010.

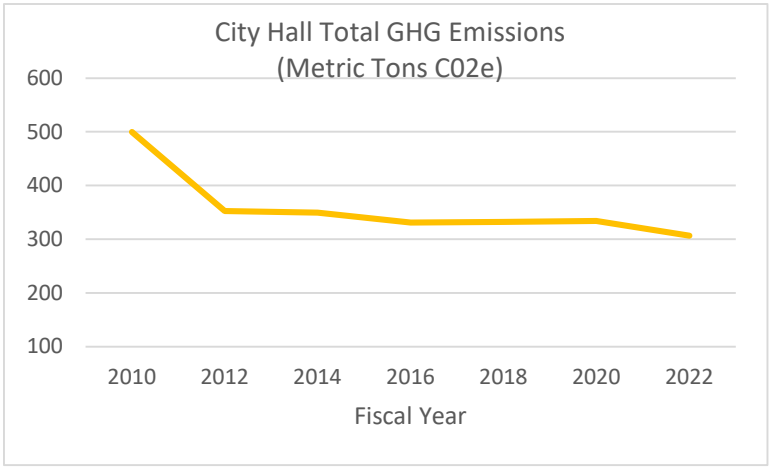
Property Information			FY 2022 Fuel Consumption				Energy Use Intensity			ENERGY STAR Score			Green House Gas Emissions		
Property Name	Property GFA - Self-Reported (ft^2)	Year Built	FY 2022 Electricity Use - Grid Purchase (kWh)	FY 2022 Natural Gas Use (therms)	FY 2022 Fuel Oil #2 Use (kBtu)	Site Energy Use (kBtu)	FY 2010 Weather Normalized Site EUI ($kBtu/ft^2$)	FY 2022 Weather Normalized Site EUI ($kBtu/ft^2$)	Percentage Improvement	FY 2010 ENERGY STAR Score	FY 2022 ENERGY STAR Score	Percentage Improvement	FY 2010 Direct GHG Emissions (Metric Tons CO2e)	FY 2022 Direct GHG Emissions (Metric Tons CO2e)	Percentage Improvement
Administration Buildings							***105.9***	***83.8***	***21%***	***38***	***53***	***39%***	***129.6***	***136.2***	***-5%***
City Hall	99,675	1878	413,213	38,932	NA	5,303,116	86.1	58.0	33%	57	88	54%	322.8	206.8	36%
Department of Recreation	4,186	2001	50,062	NA	NA	NA	NA	NA	NA	10	NA	NA	10.3	NA	NA
DPW Administration Building	20,511	1925	79,421	14,745	NA	1,745,486	99.9	94.9	5%	77	38	-51%	NA	78.3	NA
Dr. Robert F. Roberti Administration Building	56,744	1945	683,996	27,930	NA	5,126,839	122.8	95.5	22%	34	64	88%	143.8	148.4	-3%
Joseph A. Doorley, Jr. Building	79,366	1967	932,080	42,588	NA	7,439,044	121.1	93.7	23%	NA	43	NA	NA	226.2	NA
The Family and Community Engagement Center	8,700	1960	65,318	3,992	NA	622,056	99.5	76.9	23%	13	32	146%	41.3	21.2	49%

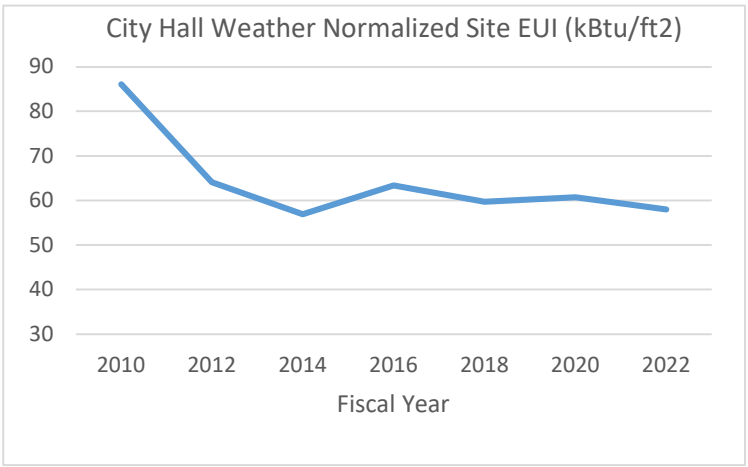
Highlight: Providence City Hall

Interior and exterior LED retrofits, BMS controls, and other energy efficiency upgrades have all played a part in reducing the energy use intensity (EUI) at City Hall to 58 kBtu/ft2, the lowest metric since FY 2014 and a 32% decrease since the baseline year of FY 2010. In comparison to FY 2010 GHG Emissions, the building has managed to save a total of 1,825.60 Metric Tons of CO2 Emissions.









Neighborhood Recreation Centers

Each of the City's eleven recreation centers is open, free of charge, to all Providence residents. In addition to athletics, the City's recreation centers house a wide range of youth and family programs. Industrial refrigeration equipment was added to these sites in 2017 for meals and snacks included as part of the program(s).[8] In 2017, three new recreation centers were opened at elementary schools in Providence, increasing the total number of rec centers owned by the City to eleven, and the number of schools doubling as recreation centers to six. The Armand E. Batastini Jr., Robert F. Kennedy, and Sackett Street Recreation Centers were newly opened at Pleasant View, Kennedy, and Lillian Feinstein, respectively. Since the energy consumed by the six recreation centers headquartered in school buildings is only a portion of the total use, their EUIs do not appear in Table 7. The average weather-normalized EUI of all rec centers combined has decreased 23% in FY 2022 since FY 2010 metrics and a 13% decrease in comparison to last year, FY 2021. Selim Madeline Rodgers decreased its EUI by a remarkable 60% in comparison to FY 2021.

Property Information			FY 2022 Fuel Consumption				Energy Use Intensity			ENERGY STAR Score			Green House Gas Emissions		
Property Name	Property GFA - Self-Reported (ft²)	Year Built	FY 2022 Electricity Use - Grid Purchase (kWh)	FY 2022 Natural Gas Use (therms)	FY 2022 Fuel Oil #2 Use (kBtu)	Site Energy Use (kBtu)	FY 2010 Weather Normalized Site EUI (kBtu/ft²)	FY 2022 Weather Normalized Site EUI (kBtu/ft²)	Percentage Improvement	FY 2010 ENERGY STAR Score	FY 2022 ENERGY STAR Score	Percentage Improvement	FY 2010 Direct GHG Emissions (Metric Tons CO2e)	FY 2022 Direct GHG Emissions (Metric Tons CO2e)	Percentage Improvement
Recreation Centers							***75.8***	***67.9***	***11%***	***NA***	***NA***	***NA***	***45.7***	***36.2***	***21%***
Davey Lopes Recreation Center	11,860	1948	43,385	8,697	NA	1,017,710	NA	94.7	NA	NA	NA	NA	72.9	46.2	37%
Neutaconkanut Recreation Center	15,345	1997	51,697	8,414	NA	1,017,812	89.4	73.2	18%	NA	NA	NA	56.3	44.7	21%
Selim Madelin Rogers Recreation Center	9,350	2000	120,113	1,515	NA	561,280	92.8	60	35%	NA	NA	NA	28.9	8.0	72%
Vincent Brown Recreation Center	18,111	1997	30,078	11,489	NA	1,251,526	57.4	76.8	-34%	NA	NA	NA	43.3	61.0	-41%
West End Recreation Center	25,760	1997	163,190	8,047	NA	1,361,480	56.1	57.1	-2%	NA	NA	NA	37.3	42.7	-14%
Zuccolo Recreation Center	11,592	1949	62,952	2,755	NA	490,252	83.5	45.3	46%	NA	NA	NA	35.2	14.6	59%

Fuel oil is no longer used in this group of buildings.
ENERGY STAR Scores are not available for this building type.

Energy Efficiency Improvements

LED Lighting Retrofits

In 2017, with the help of rebates from National Grid, the Department of Public Property oversaw LED lighting retrofits at the City's recreation centers that are saving over 95,000 kWh annually, and about $16,000 a year in City electricity costs.

Multiple investment-grade energy audits have been completed at the Davey Lopes Recreation Center in the past several years as part of a variety of potential funding programs. The Office of Sustainability and Department of Public Property have been working to identify the best solutions for conserving energy at the facility, and to identify external funding sources that could potentially allow for a zero-energy approach to updating the aging facility to also meet the challenges of climate change adaptation.

[8] Industrial refrigeration equipment was added to recreation centers in 2017 for meals and snacks included as part of the program(s), adding to the facilities' energy load.

Department of Public Works and Other Buildings

City buildings in this category include the Lillian Feinstein Senior Center, Department of Public Works (DPW), and school buildings owned by the City, but not currently under PPSD administration. Also being benchmarked is the Public Safety Maintenance Garage on Dexter Street where all City-owned police and fire vehicles are sent for repairs. Buildings at Roger Williams Park included in this category are the Dalrymple Boathouse, the Casino, and the newly renovated Museum of Natural History and Planetarium. In FY 2022, the DPW and the other buildings featured in this table, on average, increased their EUI from FY 2021 by 6%. With Covid-19 restrictions largely lifted, the skating rink area in Kennedy Plaza (formerly the Alex and Ani Center, now the Bank Newport City Center) saw a ten-fold increase in usage. Two notable buildings include the Roger Williams Park Botanical Center /Mounted Command Center and the Roger Williams Park Maintenance Facility, which reduced their EUIs by 9% and 14% respectively. These buildings have the highest EUIs of all buildings in this category so the improvement in performance is welcome.

Property Information			FY 2022 Fuel Consumption				Energy Use Intensity			ENERGY STAR Score			Green House Gas Emissions		
Property Name	Property GFA - Self-Reported (ft^2)	Year Built	FY 2022 Electricity Use - Grid Purchase (kWh)	FY 2022 Natural Gas Use (therms)	FY 2022 Fuel Oil #2 Use (kBtu)	Site Energy Use (kBtu)	FY 2010 Weather Normalized Site EUI ($kBtu/ft^2$)	FY 2022 Weather Normalized Site EUI ($kBtu/ft^2$)	Percentage Improvement	FY 2010 ENERGY STAR Score	FY 2022 ENERGY STAR Score	Percentage Improvement	FY 2010 Direct GHG Emissions (Metric Tons CO2e)	FY 2022 Direct GHG Emissions (Metric Tons CO2e)	Percentage Improvement
DPW & Other Buildings							***114.4***	***90.5***	***21%***	***NA***	***NA***	***NA***	***176.5***	***62.5***	***65%***
Alex & Ani City Center	6,373	1999	473,887	4,062	NA	2,023,101	487.4	355.7	27%	NA	NA	NA	53.5	22	60%
Camp Cronin	4,362	1960	653	NA	NA	2,229	2.2	0.5	77%	NA	NA	NA	NA	NA	NA
Central Supply	15,525	2004	34,896	5,972	NA	716,265	129.3	51.4	60%	NA	NA	NA	71.1	31.7	55%
Dalrymple Boat House	17,474	1894	47,631	2,679	NA	NA	36.9	NA	NA	NA	NA	NA	30.5	NA	NA
Dexter Street Garage	17,000	1905	73,645	12,248	NA	1,476,067	110.4	96.3	13%	NA	NA	NA	100.1	65.1	35%
DPW Maintenance, Traffic and Roller Shed	110,450	1930	156,508	24,734	NA	3,007,450	NA	30.2	NA	NA	NA	NA	627.3	131.4	79%
Lillian Feinstein Senior Center	8,520	2001	53,614	3,799	NA	562,863	36.9	71.3	-93%	NA	NA	NA	9.9	20.2	-104%
Museum of Natural History and Planetarium	19,500	1894	217,969	NA	791,706	1,535,418	109	78.3	28%	NA	NA	NA	86.5	58.8	32%
Providence Water Authority Building	46,416	1960	159,667	31,923	NA	3,737,104	NA	88.8	NA	NA	NA	NA	NA	169.6	NA
Public Safety Garage	162,976	2002	249,260	NA	NA	850,475	4.8	5.2	-8%	NA	NA	NA	NA	NA	NA
Roger Williams Park Carousel	51,600	1897	28,385	6,285	NA	725,344	26.2	15.5	41%	NA	NA	NA	47.8	33.4	30%
Roger Williams Park Maintenance Facility	27,937	1894	198,134	21,169	312,708	3,105,687	159.5	120.9	24%	NA	NA	NA	218.5	135.6	38%
RWP Botanical Center & Mounted Command	44,331	2007	169,801	68,806	NA	7,459,996	178.3	186.8	-5%	NA	NA	NA	352.3	365.5	-4%
The Casino at Roger Williams Park	16,782	1894	128,853	7,356	NA	1,175,192	92.1	75.3	18%	NA	NA	NA	46.6	39.1	16%

ENERGY STAR Scores are not available for this building type.

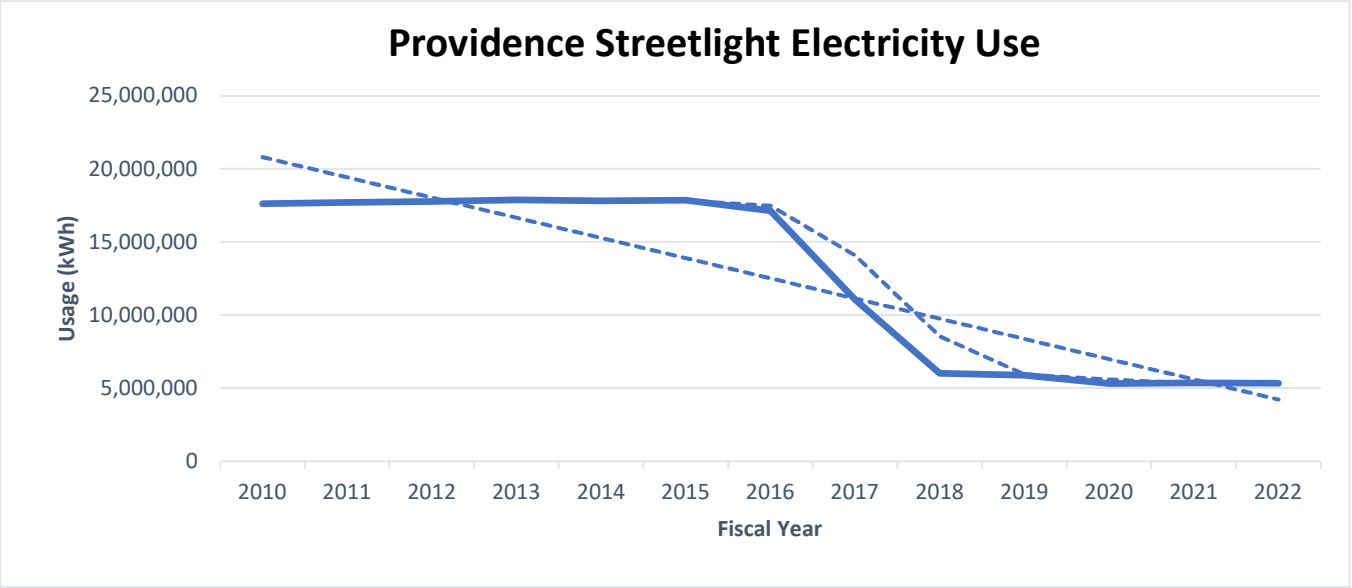


Figure 15: Providence streetlight electricity use was reduced by 12 million kilowatt hours (kWh) between FY 2015 and FY 2022.

Outdoor Lighting

Outdoor lighting, which includes the City's streetlights, accounted for 14% of the City's total electricity use in FY 2022, compared to 34% in FY 2015. The City provides lighting for City roadways, sidewalks, parks, athletic fields, playgrounds, school yards and municipal parking lots. The Department of Public Property continues to identify opportunities for low-cost outdoor LED replacement, so that outdated lighting can be replaced at all of its facilities.

In FY 2017, Providence began seeing the energy saving impacts of its LED streetlight retrofit project. The project began in 2016 when the City purchased its 16,800 cobra-style streetlights from National Grid, which previously owned and maintained the system. Rhode Island General Law (RIGL) 39-30, enacted in 2014, made the purchase and subsequent transfer of maintenance responsibility to the City possible. The purchase allowed the City to avoid costly maintenance or "facility" charges by the

utility, which totaled about $2.3 million per year. Instead, the City's 2016 streetlight maintenance contract with the Rhode Island Partnership for Streetlight Management (PRISM) replaced these charges with an all-inclusive maintenance program that costs about $463,000 annually.

Additionally, Providence's purchase of the streetlight system paved the way for the City to replace the high-pressure sodium (HPS) heads with energy saving LED fixtures capable of supporting open portal control applications, such as remote dimming. The new LED lamps and dimming schedule were able to reduce City streetlight electricity use by 12 million kilowatt hours (kWh)from a FY 2019 baseline (figure 15). The streetlight purchase and subsequent LED retrofitting has saved the City roughly $14.85 million in streetlight electricity and maintenance cost between FY 2017 and FY 2022 (figure 16).

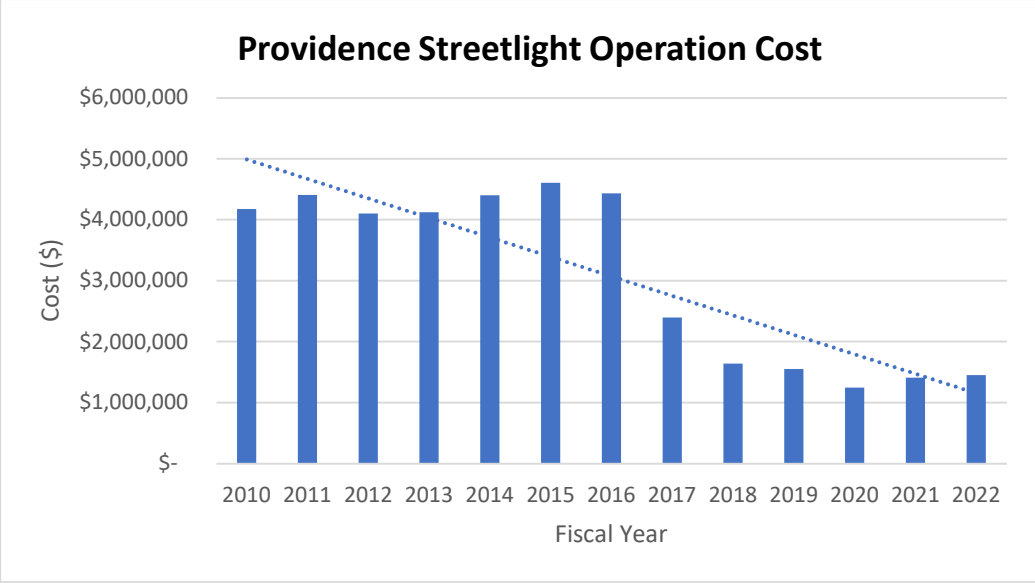


Figure 16: Providence streetlight combined electricity and operational cost was reduced by $3 million annually or nearly 70%, between FY 2015 and FY 2022.

Park and Decorative Lighting

In FY 2018, the City began retrofitting sidewalk and pathway induction lighting around the City to LED technology. The project will reduce annual City electricity consumption by over 1,000,000 kWh, and an annual savings of about $178,000.

National Grid's commercial and industrial customer rebate programs helped the City implement LED lighting retrofits at 24 of the City's parks, playgrounds and ballfields in 2017. National Efficiency Supply (NES), which expedited the program by the utility for

the City, retrofitted floodlighting and wall packs[9] at the Ardoene, Amos Earley, Miguel Luna, Billy Taylor, and Gano Street Parks, among others. Annual electricity and cost savings from these retrofits were projected to be 486,272 kWh and $72,000 respectively at the time the project was planned.

2015 LED lighting upgrades at the Roger Williams Park Zoo, supported by National Grid's upstream LED lighting program, and expedited by National Efficiency Supply (NES) are continuing to provide an annual operational savings of about $15,000. In 2016, NES retrofitted lighting at the Casino bandstand to LEDs. 23% of the project cost was covered by National Grid incentives, and the new lighting is expected to provide $3,382 in annual operational savings. NES also enabled the replacement of 375 existing 32-watt T8 florescent tubes at the Public Safety Complex's parking garage with 12-watt LED tubes. National Grid provided LED upstream lighting program incentives for the project which generated about $7,800 in annual savings.

Greenhouse Gas Emissions

Citywide Emissions

Climate Commitments

In July of 2015, Mayor Elorza joined thousands of other local government leaders around the world in signing the Compact of Mayors, which is now called the Global Covenant of Mayors, pledging the City to adopt "measurable climate and energy initiatives that lead to an inclusive, just, low-emission and climate resilient future." The agreement committed the City to developing a citywide greenhouse gas (GHG) emissions inventory consistent with the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC). The agreement also called for the City to report on climate hazards and vulnerabilities, emission reduction targets, and climate change mitigation and adaptation planning. Mayor Elorza subsequently issued an executive order on April 22, 2016 committing Providence to become a carbon-neutral city by 2050.

Emissions Reporting

The Office of Sustainability accounted for and reported Providence's citywide baseline greenhouse gas (GHG) inventory in 2015 and completed an update in 2018.[10] The citywide GHG inventory includes all emissions from all sectors within the physical city boundary and informs policy and programs to help Providence achieve its goal of

[9] Wall Packs are lighting fixtures usually found mounted on exterior walls of commercial buildings.
[10] The Office of Sustainability intends to report on the citywide GHG inventory for CY 2021, maintaining a 3-year reporting cycle. This has been delayed in CY 2022 due to limited capacity.

becoming a carbon neutral city by 2050. Citywide emissions total about 1.7 million metric tons of CO_2e; Figure 18 profiles the metric tons of CO_2e by sector. Buildings are the largest GHG contributor, accounting for roughly 70% of city-wide carbon emissions. According to the 2018 inventory, citywide emissions declined by 3.04% over the three-year span from 2015 to 2018, equating to an approximate average 1.01% reduction per year.

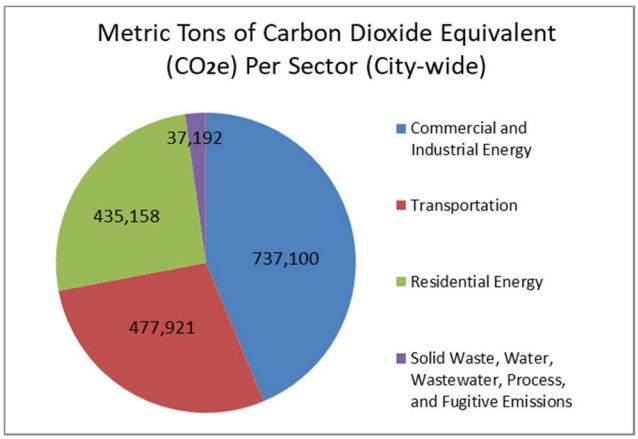


Figure 18: Providence FY 2018 greenhouse gas emissions by sector.

By demonstrating leadership in GHG accounting and reporting, the City aims to support and encourage emissions reductions in sectors not under its direct control, particularly in large buildings and institutions.

Commercial Sector Emissions Reductions

The Office of Sustainability continued to support and highlight the work of participants in Providence's voluntary energy challenge program, RePowerPVD. RePowerPVD is designed to help large buildings in the city conserve energy, save money, and gain recognition for their leadership and contributions to Mayor Elorza's goal to make Providence carbon neutral by 2050. The program is comprised of two tracks:

1. 20 percent reduction by 2025

Using a 2015 baseline, property owners may enter any building over 10,000 square feet by committing to reduce energy consumption 20 percent by 2025.

2. Race to Zero
Property owners may also enter their buildings into the "race" to become the first Zero Energy Building (ZEB) in Providence.

In 2021, there was a total of 1,924,265 Commercial Gross Square Feet pledged to report in the RePowerPVD program. The commercial buildings in the challenge reported nearly 10,000 MMBTU of energy savings in 2021, amounting to a total reduction of ~1,000 metric tons of carbon emissions in comparison to the baseline year. This is equivalent to taking 250 cars off the road in a year.

The Cornish Peerless Building was the 2021 Reduction Winner with an impressive 48% reduction in Energy Use Intensity since their benchmark year. The City's buildings, Mary. E. Fogarty Elementary School and the Department of Communications also achieved the goal of greater than 20% reduction in energy consumption in 2021.

In FY 2022, the Office of Sustainability continued to work with City Council and stakeholders to develop a **benchmarking** or **building energy reporting ordinance**. This ordinance, if passed, would require large commercial, institutional, and multifamily building owners to use ENERGY STAR Portfolio Manager to assess their buildings' energy performance and report energy use information to the City, which then verifies and discloses that data to the public. Use of ENERGY STAR Portfolio Manager helps drive energy efficiency improvements and significant energy savings.

Community Choice Aggregation
In recent years, the City of Providence, along with five other cities and towns in Rhode Island, have partnered with Good Energy for consulting services for the development and administration of a **Community Choice Aggregation** (CCA) program. The CCA program will aggregate the electrical load of electricity customers in Providence and will prioritize cost savings and emissions reductions through the purchase of local, renewable energy. The Providence City Council approved the development of an aggregation plan in 2019. Good Energy subsequently helped Providence develop an aggregation plan with community input and secure regulatory approval from the Rhode Island Public Utilities Commission (PUC). The next step is for the participating Rhode Island municipalities to procure bids for electricity supply, with coordination by Good Energy. Robust education and outreach on community choice aggregation will begin once electricity supply has been procured.

Emissions from City Operations
City buildings and outdoor lighting account for only 2.54% of citywide building emissions. Nonetheless, the City of Providence expects to lead by example in reducing emissions from its energy use. The 2014 Sustainable Providence Plan set out goals and

strategies to reduce energy use in municipal buildings. The 2019 Climate Justice Plan further aims to eliminate all climate pollution from municipal operations by 2040, prioritizing city-owned schools and facilities most used by low income, communities of color and in cumulative pollution areas.

Greenhouse gas emissions from our City buildings and outdoor lighting have steadily decreased since 2010. FY 2022 municipal GHG emissions are estimated to have been 27,304 metric tons, less than a 1% decrease from FY 2021, but still 28% below the 37,792 metric ton 2010 baseline. Emissions reductions have occurred due to building-level electric and heating improvements (e.g. oil to natural gas conversions and energy efficiency measures), and due to the region's power plants switching from coal and oil to natural gas to generate electricity.

Figure 19 shows the direct and indirect greenhouse gas emissions from municipal buildings and outdoor lighting. The 28% reduction from the 2010 baseline is the result of strategic investments in City facilities including building upgrades, converting City street lights to LEDs, and employee education around energy conservation.

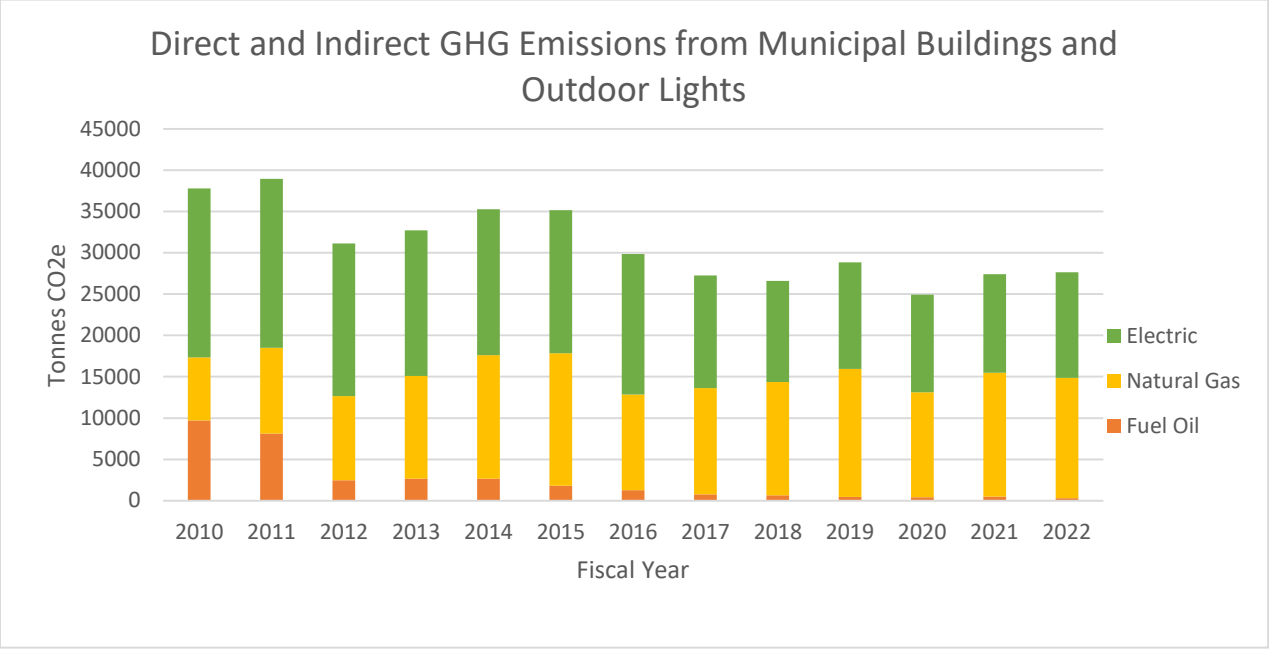


Figure19: Greenhouse gas emissions from municipal buildings and lighting, shown in metric tons of CO_2 equivalents, FY 2010 - FY 2022.