Photo by Stephanie Izzo *www.stephanieizzo.com*

SUSTAINPVD

Municipal Energy Report *FY 2015*

Executive Summary

The Providence Municipal Energy Report discloses the City's 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 reduce energy consumption 30 percent by 2030. Measuring and monitoring consumption by benchmarking buildings is an important first step to achieving this goal. Benchmarking is a means of comparing a building's energy use to the average of similar buildings or to an established baseline.

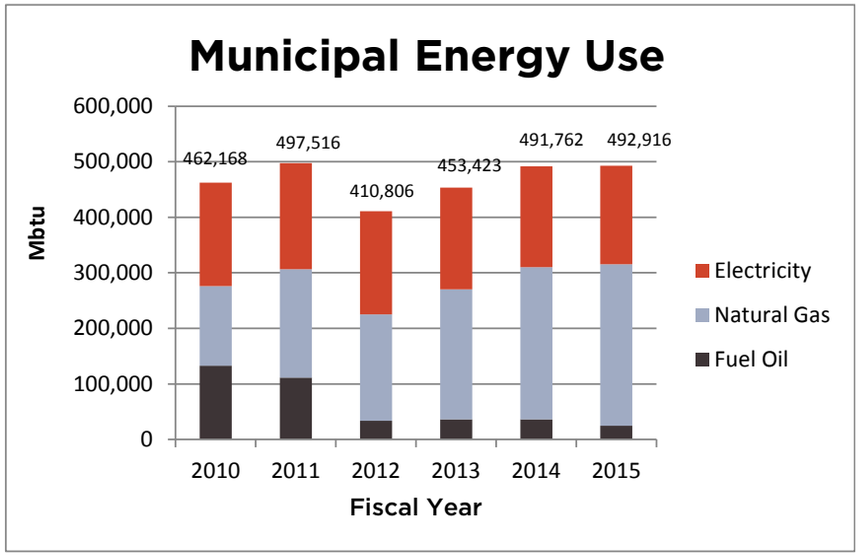

Figure 1: City of Providence's electricity, natural gas, and fuel oil consumption, 2010 - 2015.

The City of Providence has been benchmarking and monitoring its energy consumption as part of its fiscal and environmental agenda since 2010. The City uses the U.S. Environmental Protection Agency's Energy Star Portfolio Manager to track all of the City's electric, gas, oil, and water consumption. The energy data from the City's 5.4 million square feet of building space and all of the electricity used for Providence's roadway, decorative, and park area-lighting help the City manage its energy consumption and identify opportunities for savings. The information in this report summarizes the full dataset, which is now available on the City's Open Data Portal.

The City's facilities, including buildings and outdoor lighting, used 492,916 MBtu[1] of energy in FY 2015 in the form of electricity, natural gas, and oil

Highlights:

- Total energy use has remained relatively constant since 2010 and correlates closely with weather.
- The City's expenditures on energy have declined by seven percent between FY 2010 and FY 2015.
- Approximately one-third (15 out of 43) Energy Star buildings qualify for certification, meaning they perform better than more than 75% of similar buildings.
- 19 Energy Star scored buildings have improved their Energy Star scores between 2010 and 2015.
- Greenhouse gas emissions from municipal buildings and outdoor lighting have gone down 11% since 2005, largely due to fuel switching.
- The City has reduced #2 fuel oil consumption by over 80%
- Investments in lighting and mechanical efficiency measures have reduced electricity consumption by almost five percent since 2010.
- Future investments in energy efficiency, including converting all of the City's streetlights to LEDs and using the Rhode Island Infrastructure Bank's Efficiency Building Fund to finance over $1 million dollars in energy efficiency projects will accelerate energy and costs savings in the coming years.

[1] Since quantities of electricity, gas and oil are measured in different ways (kWh, therms and gallons, respectively), British thermal units (Btu's) can be used to express the energy content of the different fuel types so that consumption can be expressed as a combined unit. In this way, the City can track its total consumption of electric, gas, and oil year-to-year.

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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 2015 Providence Municipal Energy Report presents the City's energy data publically to increase 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.

This work is part of the City's broader sustainability initiative. In 2014, the City released its first comprehensive sustainability plan, Sustainable Providence. This plan set a goal for the City to "achieve a minimum of 30 percent energy use reduction by 2030 on all City-owned property." To meet this goal, it calls for investments in clean and renewable energy and energy efficiency projects. 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 Compact of Mayors, a global coalition of mayors pledging to reduce greenhouse gas emissions and enhance climate resilience. Also in 2015, Mayor Elorza and the City Board of Investment Commissioners, following a 2013 vote by the City Council, made the unanimous decision to divest the City's finances from major fossil fuel-emitting companies.

Under Mayor Elorza's continued leadership on fiscal and environmental responsibility, the City of Providence is among the nation's leading municipalities by benchmarking its buildings and publicizing annual energy reports. Benchmarking is the practice of comparing building energy use to either other similar buildings, or historical data in an effort to manage energy consumption. While Providence has data going back many more years than most cities, this report marks the first time this data will be presented to the public. Other cities that have produced similar reports in recent years include San Francisco, Boston, New York, and Seattle.

Measuring municipal energy use is the first step in meeting the City's energy and greenhouse gas reduction goals. 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 sites for new energy conservation measures, and manage energy spending. The data has also been used for initiatives such as the City's recent solar feasibility study, and Providence's ongoing stake in the Georgetown University Energy Prize, a two-year competition against other US cities for a $5 million prize.

City Energy Use

Overview

The City's facilities, including buildings and outdoor lighting, used 492,916 MBtu[2] of energy in FY 2015 in the form of electricity, natural gas, and fuel oil. The City has implemented fuel-switching technology, replacing oil-burning furnaces with more affordable and cleaner-burning natural gas. As a result, oil use has declined considerably, while natural gas use has increased (seen in figure 3 and 4). In 2015, natural gas accounted for roughly half of municipal buildings' energy consumption at 290,621 MBtu, electricity accounted for 177,760 MBtu, and oil use was 24,634 MBtu.

Since 2010, energy consumption has remained relatively flat, 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, which is tracked by Heating Degree Days (HDD[3]), a standard means of normalizing energy data to weather. For example, 2012 was an extremely mild winter; therefore, the City's energy use dropped significantly. The data also show that while 2013 and 2014 were colder winters (more HDDs), they City's energy use remained relatively constant. This reflects the many investments made in energy conservation.

Other factors that contribute to variations in energy consumption include energy efficiency improvements and changes to the use and/or operation of the building. However, weather is typically the primary factor in energy use fluctuations.

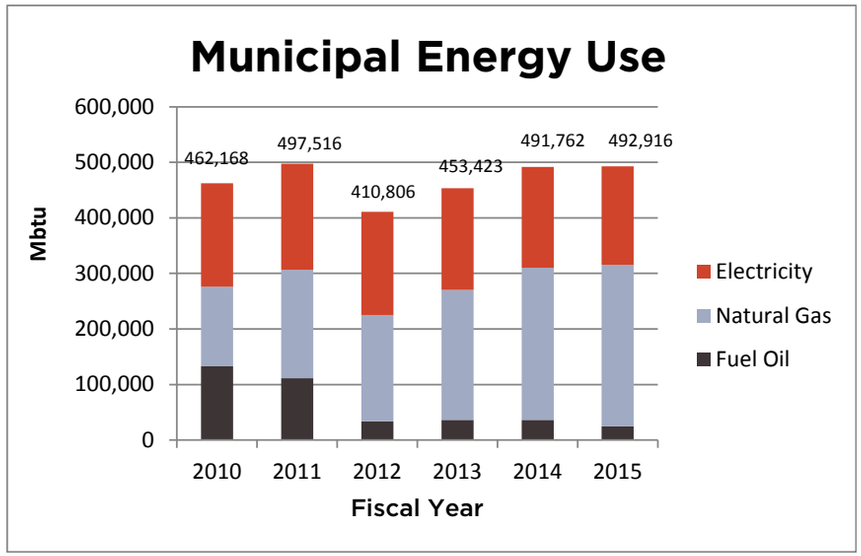


Figure 1: City of Providence's electricity, natural gas, and fuel oil consumption, 2010 - 2015.

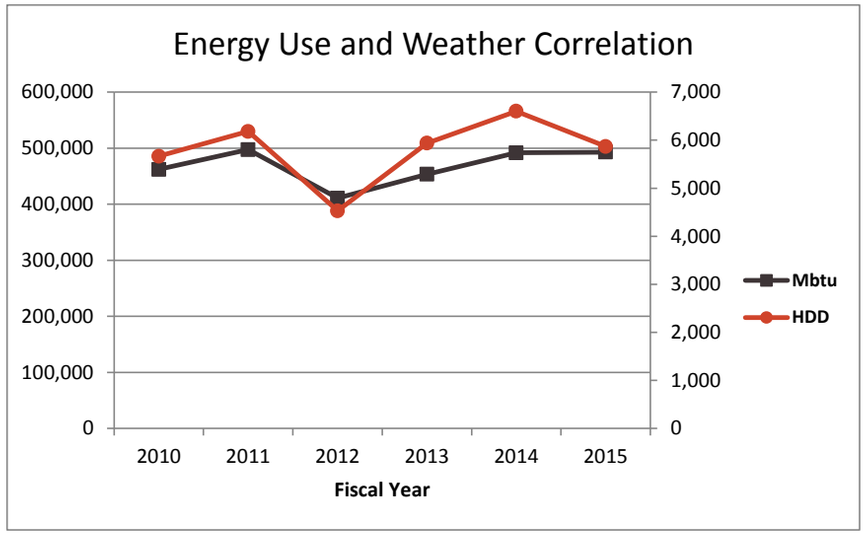


Figure 2: Correlation of municipal energy use and weather, 2010 - 2015.

[2] Since quantities of electricity, gas and oil are measured in different ways (kWh, therms and gallons, respectively), British thermal units (Btu's) can be used to express the energy content of the different fuel types so that consumption can be expressed as a combined unit. In this way, the City can track its total consumption of electric, gas, and oil year-to-year.

[3] Heating Degree Days (HDD) are 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).

Electricity

In FY 2015, the City of Providence used 52,700,036 kWh of electricity, a four percent reduction from its FY 2010 baseline. Lighting retrofits at Providence's schools and municipal-use buildings, along with transitions to more energy efficient electronics and appliances have played a significant role in lowering electricity use.

Thermal

The City of Providence has two sources of thermal energy: natural gas and #2 fuel oil. In the past five years, boilers in fourteen school buildings and six municipal buildings have been converted from oil to natural gas, resulting in a reduction of fuel oil from over 1 million gallons in 2010 to less than 200,000 gallons in 2015. The volume of natural gas used by the City has increased proportionately to the amount of systems retrofitted. With two more conversions planned for 2016, the City will eliminate fuel oil consumption from its schools within the next year(see Table 1).

Relative to fuel oil, natural gas is a cleaner-burning fuel and provides a considerable greenhouse gas reduction; however, it is only considered an energy efficiency measure when performed in concert with energy efficient upgrades such as installing condensing boilers or advanced monitoring systems.

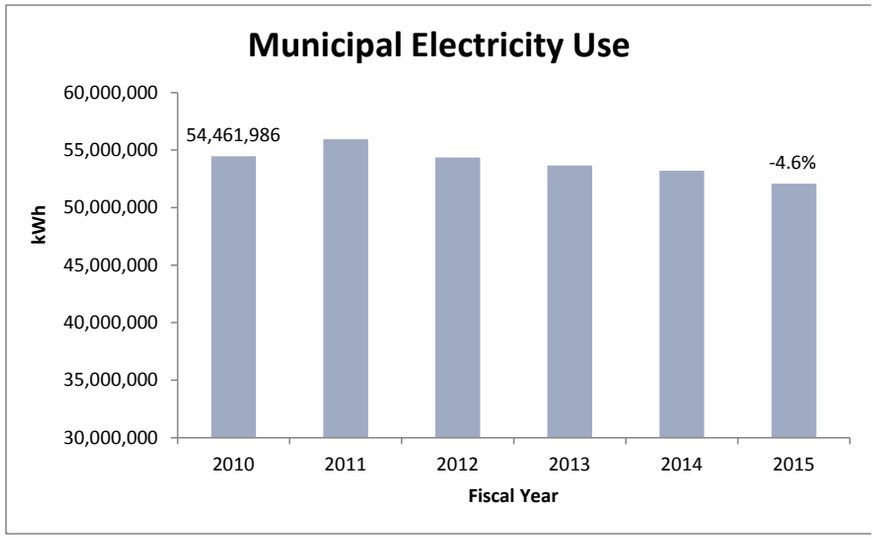


Figure 3: City of Providence's electricity use shown in kWh, 2010 - 2015. Electricity consumption has declined by almost 5% since 2010.

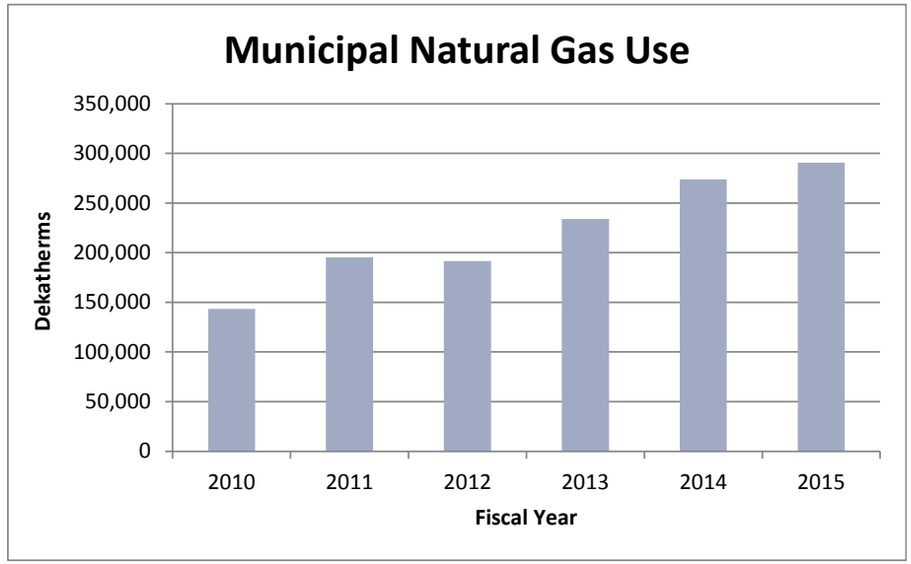


Figure 4: City of Providence's natural gas use, shown in dekatherms, 2010 - 2015. Consumption has increased roughly 50% due to converting from oil to natural gas (see Table 1).

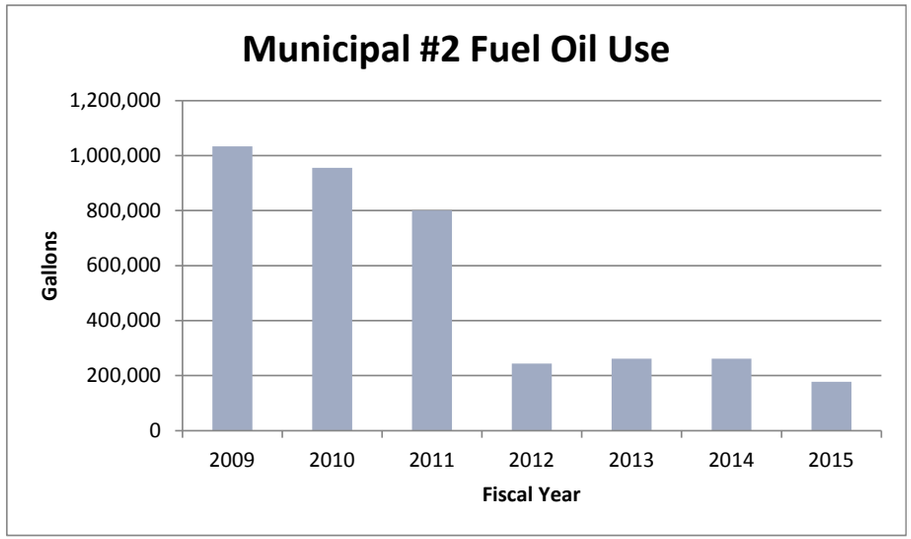


Figure 5: City of Providence's fuel oil consumption, shown in gallons, 2010 - 2015. Consumption has declined by over 80% due to converting to natural gas systems.

Table 1: Municipal Buildings Converted from Fuel Oil to Natural Gas

	Year of Conversion
Alan Shawn Feinstein Elementary School @ Broad Street	2011
Asa Messer Elementary School @ S.W. Bridgham	2011
Dr. Martin Luther King Elementary School	2011
George J. West Elementary School	2011
Harry Kizirian Elementary School	2011
Mary Fogarty Elementary School	2014
Robert F. Kennedy Elementary School	2011
William D'Abate Elementary School	2011
Esek Hopkins Middle School	2011
Gilbert Stuart Middle School	2014
Nathanael Greene Middle School	2011
Roger Williams Middle School	2011
Mount Pleasant High School	2010
Central High School [4]	2011
Frank D. Spaziano Elementary School	2016
Lillian Feinstein Elementary School	2016
Webster Avenue Elementary School	2016 (planned)
West Broadway Middle School	2016 (planned)
Providence City Hall	2009
The Family and Community Engagement Center	2014
DPW Administration building	2009
Traffic and Engineering/VIN building & Roller Shed	2010
Admiral Street Fire Station	2011
Allens Avenue Fire Station	2012
North Main Street Fire Station	2011

[4] The Central High heating plant provides heat to Classical High School, as well.

Greenhouse Gas Emissions

While energy consumption has remained relatively constant and closely correlated to weather, the City's greenhouse gas (GHG) emissions from its energy supply have steadily decreased. In FY 2015, municipal GHG emissions are estimated to be 37,038 tons, down 11% from 41,664 tons in FY 2010, despite the fact that 2015 saw about 3.5% more heating degree days, meaning it was a colder winter.[5] The decrease is due largely to fuel switching from coal and oil to natural gas. This has occurred both at the building-level for thermal energy (oil to natural gas), and for electricity at the grid level, as many of the region's power plants have also made the switch to cheaper, cleaner-burning natural gas.

Energy Procurement Strategy and Costs

The Department of Public Property has looked to energy conservation measures to combat ever-increasing energy costs and to continue to do more with less. Rhode Island Public Utility Commission (RIPUC) historic data shows that National Grid's average cost of electricity has risen roughly 57% since 2011, from an average cost of 6.09 cents/kWh to 10.82 cents/kWh in 2015. Despite these rising costs, the City has managed to reduce its operating costs for energy significantly since 2010.

In addition to oil to natural gas conversions and energy efficient measures, energy procurement strategies have played a significant role in reducing the City's energy costs. The City has engaged a third-party supplier, Direct Energy, to establish long-term, fixed prices. The electricity supply contracts have saved the City over $3.5 million over the course of four years, compared to what it would have paid for electricty supplied by National Grid. Such contracts are enabled by the Energy Policy Act of 1992, which decoupled electricity distribution (retained by the utilities), from suppliers.

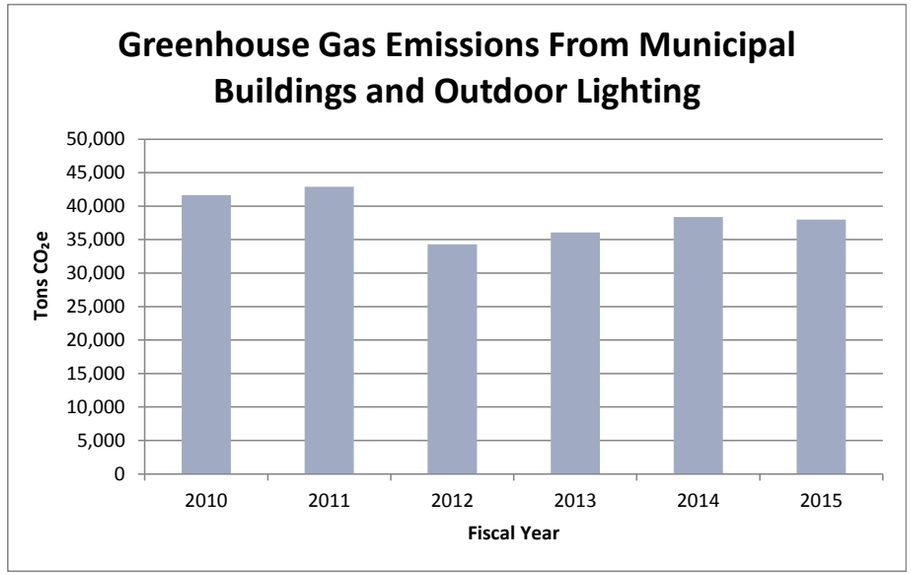


Figure 6: Greenhouse gas emissions from municipal buildings and lighting, shown in tons of CO_2 equivalents, 2010 - 2015.

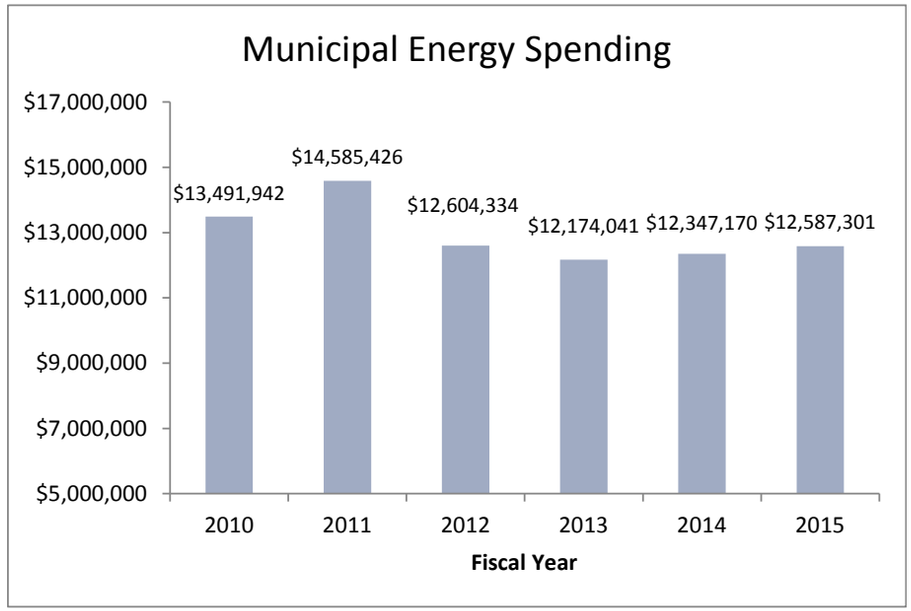


Figure 7: Municipal spending on energy, 2010 - 2015. Despite rising energy costs, spending has decreased by 7%.

[5] Greenhouse gas emissions were calculated using Peregrine Focus, which uses ISO New England's emission factor to calculate emissions from electricity. This factor could vary slightly from the City's energy supplier, Direct Energy (discussed in the next chapter); however it is a close approximation.

The Rhode Island Energy Aggregation Program (REAP) is a consortium of 36 Rhode Island cities and towns organized for the purpose of purchasing electricity and other energy related services from energy power suppliers at the lowest possible prices and with the highest quality of service. RI General Law 45-55-13.2 allowed REAP to begin taking bids from power providers in 1999.

In 2003, the City began working with the Rhode Island League of Cities and Towns(RILCT) and REAP for assistance in procuring discounted bulk electricity. In 2011, RICLT members and consultants selected Direct Energy as their energy provider to offer power under REAP guidelines. By this time, the City was already buying most of its natural gas from Direct Energy, having participated in a procurement program sponsored by the Rhode Island Association of School Committees. The separate electricity rates were negotiated through REAP on the City's behalf for municipal buildings and schools based on demand load.

Benchmarking Buildings

Benchmarking a building allows for review of its energy performance despite intrinsic variables such as a building's size, age, type of use, level of occupancy, and other factors such as weather. Benchmarking municipal buildings helps the City identify opportunities for energy efficiency savings, track building performance, 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.

Energy Star Portfolio Manager is a free online building benchmarking tool developed by the United States Environmental Protection Agency. It enables users to create building profiles by entering basic site information such as year built and total square footage. The user enters a minimum of one year's worth of energy bills for each fuel type. Portfolio Manager then calculates the building's site energy use intensity (EUI) by dividing its total energy used in a single year, represented in kBtu, by its gross square footage. For example, the EUI of a 136,000 square foot school building that used 11,076,000 kBtu of energy in a single year would be 81. Portfolio Manager then calculates the building's source energy use [6] intensity. Next, the PM uses a regression equation specific to each property type that reflects data from the US Energy Information Administration's 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 on the basis of site EUI. For the purpose of this report, site EUI for each facility is compared to the site EUI of other City municipal buildings of a similar a type, all sharing the same climate and weather patterns, characteristics not represented by the national survey data.

[6] Unlike site energy use, source energy use includes losses that take place during the generation, transmission and distribution of energy. Some buildings house more than one school, so these 37 school buildings house a total of 42 schools.

Energy Star Portfolio Manger uses utility billing data, along with details about the facility itself including area (sq. ft.), year built, and occupancy to benchmark sites against a national median comprised of buildings with the same characteristics. The software also tracks how buildings perform over time, using a predetermined baseline. Portfolio Manager uses 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 energy a building uses. Portfolio Manger also calculates scores for buildings in certain categories, so that they can be recognized with Energy Star certification.

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 37 school buildings [7], one public safety complex, nine district police sub-stations, 13 fire stations, eight recreation centers, three maintenance buildings, 35 park buildings, and seven administration buildings. The school's roughly 4.2 million square feet of space accounts for 76% of the City's portfolio. Of the remaining 27% of building space, public safety buildings account for 35%, administration buildings, such as City Hall, account for 25%, recreation centers and DPW buildings total 11%, and buildings for public assembly such as The Casino at Roger Williams Park, and those at the North Burial Ground account for 7%. 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.

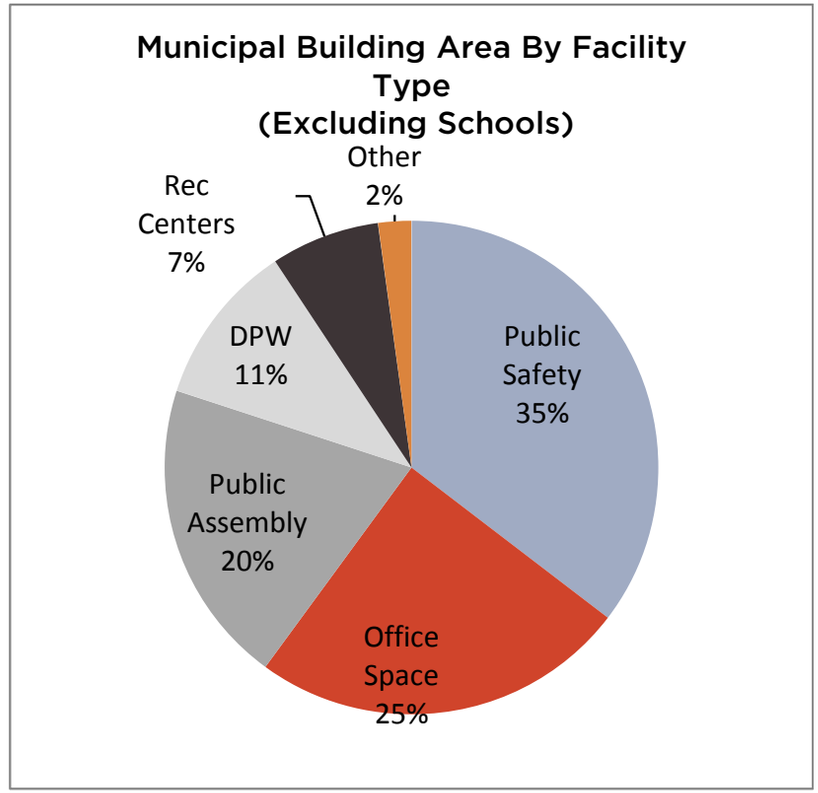


Figure 8: Municipal building area percentage by facility type in 2015. Percentages based on building square footage. This graph excludes schools, which accounts for 76% of the building portfolio.

[7] Some buildings house more than one school, so these 37 school buildings house a total of 42 schools.

The buildings in the City's portfolio were constructed within a span of over one-hundred fifty years, with Providence City Hall being one of the oldest, built in 1878. The newest building in the City 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, who provided guidelines on design and construction best practices for saving energy. Newer buildings owned by the City have incorporated more advanced lighting and HVAC technologies, and efficiency guidelines, resulting from advancements in the Rhode Island State building codes, particularly the SBC-8 (RI Energy Conservation Code), the 2013 sixth edition of which aligns with the 2012 International Energy Conservation Code.

Identifying building use-types and age in this way helps in understanding the energy needs. For instance, a public safety building such as a fire station, compared to an office building of similar size, may use more energy for heating and cooling, based on the fact that its garage doors open and close frequently. Fire and police stations are also generally occupied around-the clock, unlike offices or recreation centers.

Building age can also be a factor. The year in which a building is constructed reflects the building and energy codes and standards of its time. It is often perceived that older buildings are less inefficient; however, buildings constructed before the advent of HVAC systems and cheap and accessible energy, were designed to be comfortable without these technologies. As a result, they are often low consumers of energy when compared to more modern facilities. As you can see in Figure 10, the oldest and newest buildings are some the City's our most energy efficient.

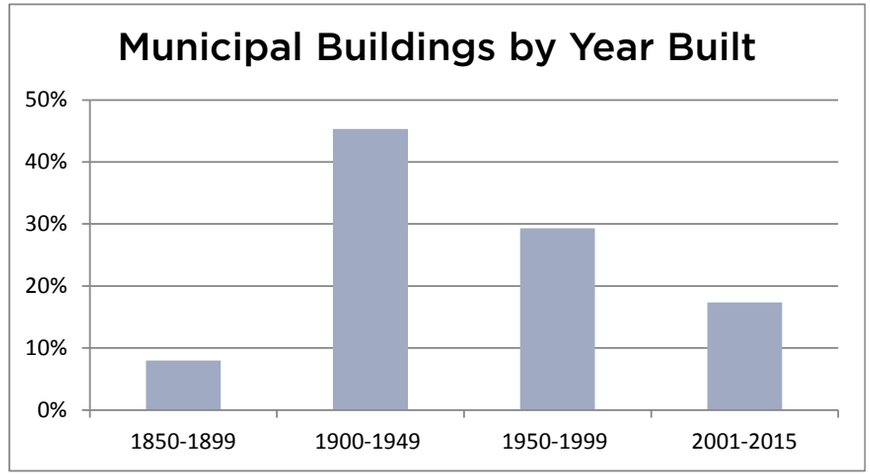


Figure 9: Municipal buildings by year built shown as a percentage. Most of the City's building portfolio was built in the early 20th century.

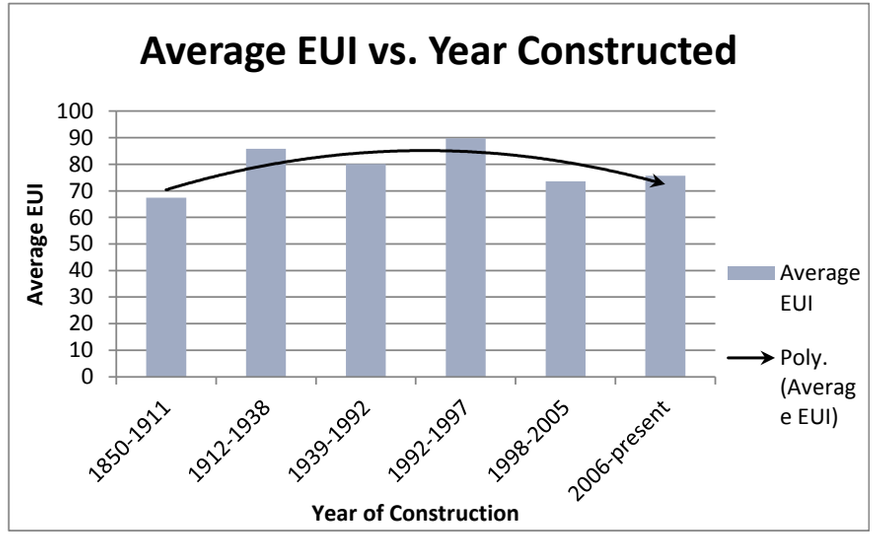


Figure 10: This graph compares year of construction with building's energy use intensity (EUI). Older municipal buildings, built before the advent of energy-intensive heating, cooling and lighting systems, are some of the City's lowest energy consumers per square foot. New policies such as the International building code of 1997 and energy policy act of 2005 have also influenced energy performance in modern buildings.

Schools

The City of Providence currently has 42 K-12 schools operating in 37 school buildings. Five of the 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. In 2015, the City renewed its 2005 contract with Aramark to continue providing facility management services for Providence Schools. 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. Aramark also coordinates all of the energy efficiency projects in the City's schools and is an important partner. Aramark initaites numerous lighting and efficiency projects, and will be installing new weather stripping in schoools district-wide in 2016 using custom rebates from National Grid. While much of the work for maintaining and upgrading systems is included in Aramark's operating budget, large scale projects depend on financing from the City, and funding from state and/or federal programs, when available.

As the majority of the City's building area, City schools account for most of Providence's municipal energy use. Providence's schools used 313,548 of the 492,916 MBtu (64%) of combined electric, oil and gas used by the City in Fiscal Year 2015. Schools tend to have high levels of occupancy and longer operational hours when compared to other municipal buildings, making them particularly intensive energy consumers. Many school buildings are also increasingly being used for after school activities including athletics and other youth and community programs. Furthermore, over the past few years, Providence's classrooms have been supplied with a growing number of computers and other electronic technology that drives up energy consumption. The City is exploring new cost-effective programs and software to obtain real-time energy data to identify waste, and better track the implementation of and savings associated with energy efficiency measures.

Elementary Schools

Six of the City's 22 elementary schools have Energy Star scores of 75 or above, qualifying them to be Energy Star certified buildings. The current data, in addition to showing better performance amongst the newer buildings, also demonstrates that older schools are capable of achieving lower EUIs. For example, Allan Shawn Feinstein and Frank D. Spaziano Elementary schools were constructed in 1908 and 1895, respectively, yet they have some of the highest Energy Star scores in the portfolio. Pleasant View does not currently have an Energy Star score due to an incomplete natural gas dataset, which the City is working on resolving.

Table 2: Elementary School Buildings Energy Performance and Benchmarking

Facility Elementary Schools	Year Built	Gross Floor Area (sq. ft.)	FY 2015 Electricity Use (kWh)	FY 2015 Natural Gas Use (therms)	FY 2015 Fuel Oil #2 (kBtu)	FY 2015 Total Site Energy Use (kBtu)	FY 2015 Direct GHG Emissions (Metric Tons CO2e)	FY 2010 Site EUI (kBtu/ft^2)	FY 2015 Site EUI (kBtu/ft^2)	FY 2010 ENERGY STAR Score	FY 2015 ENERGY STAR Score	ENERGY STAR score Change
							Averages:	**67.8**	**71.6**	**61.2**	**56.7**	
Robert. L Bailey, IV Elementary School	2000	78,000	415,786	17,974		3,216,084	95.5	44.3	41.2	92	95	↗
Frank D. Spaziano Elementary School	1908	58,015	118,735	2,377	1,955,736	2,598,547	157.8	68.5	44.8	71	93	↗
Leviton Dual Language School	2002	40,000	266,058	11,731		2,080,891	62.3	47.4	52	90	88	↘
Allan Shawn Feinstein Elementary School @ Broad Street	1895	77,899	132,246	63,893		6,840,477	339.4	70.8	87.8	92	81	↘
Lillian Feinstein Elementary School @ Sackett Street	1921	68,400	264,560	14,724	1,653,378	4,028,439	200.9	56.9	58.9	81	81	→
B. Jae Clanton Complex	2004	103,000	608,800	44,699		6,547,137	237.4	85.1	63.6	56	76	↗
Dr. Martin Luther King Elementary School	1959	71,724	297,908	36,227		4,639,140	192.4	58.6	64.7	81	73	↘
Anthony Carnevale Elementary School	1999	78,000	572,133	18,639		3,815,991	99	53.7	48.9	61	70	↗
Webster Avenue Elementary School	1904	44,290	166,954		2,186,058	2,755,705	162.2	56.5	62.2	79	69	↘
Mary E. Fogarty Elementary School	1959	51,400	149,103	34,168		3,925,533	181.5	61	76.4	72	55	↘
Robert F. Kennedy Elementary School	1921	49,840	132,943	40,246		4,478,175	213.8	84.4	89.9	60	52	↘
Asa Messer Elementary School @ Samuel W. Bridgham	1972	109,255	590,808	49,451		6,960,950	262.7	68.8	63.7	48	51	↗
Harry Kizirian Elementary School	1959	73,950	261,791	46,160		5,509,197	245.2	64.2	74.5	65	50	↘
Carl G. Lauro Elementary School	1921	117,482	208,946	86,406		9,353,504	458.9	56.9	79.6	69	43	↘
William D'Abate Elementary School	1959	44,174	197,510	40,142		4,688,132	213.2	104.6	106.1	37	37	→
Frank D. Spaziano Elementary School Annex	1910	19,585	81,095	12,632		1,539,939	67.1	67.2	78.6	55	36	↘
George J. West Elementary School	1959	112,030	231,106	90,366		9,825,150	480	65.6	87.7	64	34	↘
The Leviton Complex	1908	178,654	909,924	66,408		9,745,501	352.7	52.9	54.5	30	31	↗
Reservoir Avenue Elementary School	1924	22,000	85,956	16,313		1,924,562	86.6	74.8	87.5	43	30	↘
Veazie Street Elementary School	1909	110,000	363,647	76,217		8,862,443	404.8	81.7	79.8	22	27	↗
Vartan Gregorian Elementary School	1954	63,000	249,058	55,328		6,382,574	293.9	98.9	101.3	18	19	↗
Pleasant View Elementary School*	1971	74,800	345,186									

* Due to a technical issue with the facility's natural gas use data, total energy use, emissions, EUI and Energy Star score for Pleasant View are not currently available.

Energy Efficiency Improvements

Working closely with Aramark and National Grid, the City has implemented numerous energy efficiency measures throughout the City's elementary schools including building management systems (BMS), heating system, and lighting upgrades.

Building Management System Upgrades

Aramark has completed building management systems (BMS) upgrades at four elementary schools: B. Jae Clanton, Lillian Feinstein, Dr. Martin Luther King, Jr., and Veazie Street, with plans for upgrading those at Robert L. Bailey, IV and Anthony Carnevale in 2016.

Heating and Cooling System Upgrades

Heating system steam traps [8] were upgraded at Harry Kizirian, Allan Shawn Feinstein and George J. West Elementary Schools as part of National Grid's steam trap program in 2014 and 2015. For 2016, Aramark has also proposed replacing both antiquated boilers at The Leviton Complex with condensing boilers, and removing the steam system. The same has been proposed for Dr. Martin Luther King, Jr., along with the installation of a gas-fired domestic water heater.

LED Lighting Retrofits

Dr. Martin Luther King, Jr. will also be one of seven elementary schools along with Carl Lauro, Frank Spaziano, Webster Avenue, Anthony Carnevale, Asa Messer @ Samuel W. Bridgham, and Veazie Street to be retrofitted with new LED lighting in 2016. The Department of Public Property will eventually retrofit all City buildings with LED lighting. A total of fifteen LED retrofits are planned for City schools in 2016, and are expected to save roughly 2,443,306 kWh of electricity, preventing about 1,857 tons of greenhouse gas from escaping into the atmosphere. The measures are also expected to save the City about $390,929 annually. The increased life span of the lamps (up to 70,000 hours) will significantly reduce maintenance costs, as well. Eighteen schools also received 595 new LED stairwell fixtures free of charge via National Grid's municipal upstream lighting program. The retrofitting of the new stairwell lamps was performed by Aramark electricians.

[8] A steam trap valve allows for the discharge of condensate and non-condensable gases with a negligible loss of steam.

Middle Schools

Five of the City's six middle school buildings represent some of the City's oldest schools buildings, with Esek Hopkins being the oldest, built in 1916. Esek Hopkins also has the highest Energy Star score at 76, making it eligible for Energy Star certification. Roger Williams and Nathanael Greene have the lowest scores, along with particular high EUI. Recent and planned energy efficiency improvements at Gilbert Stuart, Roger Williams, and Nathanael Greene should all help address these low Energy Star scores.

Energy Efficiency Improvements

Building Management System Upgrades

BMS upgrades were completed at Esek Hopkins in 2014.

Heating and Cooling System Upgrades

The #1 boiler at Gilbert Stuart Middle School was replaced, including the addition of new gas distribution controls. Plans are in place to replace the #2 boiler, installing a vacuum return system and a properly-sized condensate tank.

LED Lighting Retrofits

Esek Hopkins, Gilbert Stuart, Roger Williams, and Nathanael Greene have had their stairwell lighting retrofitted with LED fixtures through National Grid's upstream program, which was at no cost to the City. In addition, Aramark replaced existing high-wattage auditorium lamps with LEDs in 2014. Aramark and National Grid plan to upgrade the BMS at Governor Christopher DelSesto in 2016, and the site will be one of three middle schools, also including Esek Hopkins and Nathanael Greene, to have LED retrofits completed in 2016.

Table 3: Middle School Buildings Energy Performance and Benchmarking

Facility Middle Schools	Year Built	Gross Floor Area (sq. ft.)	FY 2015 Electricity Use (kWh)	FY 2015 Natural Gas Use (therms)	FY 2015 Fuel Oil #2 (kBtu)	FY 2015 Total Site Energy Use (kBtu)	FY 2015 Direct GHG Emissions (Metric Tons CO2e)	FY 2010 Site EUI (kBtu/ft^2)	FY 2015 Site EUI (kBtu/ft^2)	FY 2010 ENERGY STAR Score	FY 2015 ENERGY STAR Score	ENERGY STAR score Change
							Averages:	65.9	74.6	55.0	44.7	
Esek Hopkins Middle School	1916	87,560	288,139	34,526		4,435,737	183.4	45.7	50.7	78	76	↘
DelSesto Middle School	1998	146,000	860,887	49,945		7,931,810	265.3	53.8	54.3	57	64	↗
West Broadway Middle School	1966	46,000	166,775		2,801,814	3,370,849	207.9	95.3	73.3	45	60	↗
Gilbert Stuart Middle school	1929	154,450	311,784	103,104		11,374,184	547.6	52.3	73.6	67	38	↘
Nathan Bishop Middle School*	1929	136,000	1,401,960	63,527		11,136,189	337.4		81.9		34	↗
Nathanael Greene Middle School	1930	159,070	290,193	133,898		14,379,894	711.2	61.5	88.8	50	23	↘
Roger Williams Middle School	1929	135,228	375,653	121,772		13,458,908	646.8	87	99.5	33	18	↘

*Nathan Bishop Middle School was closed for two years, prior to its September 2009 re-opening, resulting in insufficient data to generate FY 2010 metrics.

High Schools

The City owns eight high school buildings, and like some of the City's elementary schools, a few of the City's dedicated high school buildings house two or more schools with different names, such as The Juanita Sanchez Educational Complex, which houses both William B. Cooley, Sr. High School, and The Providence Academy of International Studies. In like manner, Mount Pleasant and Hope High Schools now house two of the City's "Opportunity by Design" high schools, Evolutions and 360, respectively. Central and Classical High Schools are grouped together for the purposes of this report, and whenever measuring energy used for heating the schools because the two facilities share a common heating plant situated between the two schools.

With a wide variety of on-going academic, athletic, and cultural programs, Providence's high schools' lighting, computers, and heating and cooling systems are relied on by students and faculty well after the end of the school day. However, many of these facilities are high performers with four of the seven facilities qualifying for Energy Star certification.

Table 4: High School Buildings Energy Performance and Benchmarking

Facility High Schools	Year Built	Gross Floor Area (sq. ft.)	FY 2015 Electricity Use (kWh)	FY 2015 Natural Gas Use (therms)	FY 2015 Fuel Oil #2 (kBtu)	FY 2015 Total Site Energy Use (kBtu)	FY 2015 Direct GHG Emissions (Metric Tons CO2e)	FY 2010 Site EUI (kBtu/ft^2)	FY 2015 Site EUI (kBtu/ft^2)	FY 2010 ENERGY STAR Score	FY 2015 ENERGY STAR Score	ENERGY STAR score Change
							Averages:	**61.0**	**69.9**	**75.5**	**74.7**	
Central/Classical High School	1962	454,059	2,181,474	176,033		25,046,534	935	57.3	55.2	56	93	↗
E-Cubed Academy	2004	44,600	276,612	14,378		2,381,645	76.4	50.3	53.4	79	89	↗
Mount Pleasant High School	1938	320,000	957,941	235,772		26,845,680	1252.3	71.3	83.9	91	83	↘
Hope High School	1938	257,089	860,110	213,946		24,329,345	1136.4	67.3	94.6	92	75	↘
Dr. Jorge Alvarez High School	2007	88,000	642,268	41,331		6,324,503	219.5	53.3	71.9	70	55	↘
Juanita Sanchez Educational Complex	2004	110,000	982,333	59,297		9,281,463	315	66.2	84.4	65	53	↘
Providence Career and Technical Academy*	2009	300,000	2,058,564	67,147		13,738,544	356.7		45.8			

*Energy Star does not currently have a building category for technical schools, therefore PCTA is not presently eligiable to receive an Energy Satr score. In addition, the school's September 2009 opening resulted in insufficient energy data to generate FY 2010 metrics.

Energy Efficiency Improvements

Heating and Cooling System Upgrades

Energy efficieny projects completed by the Department of Public Property and Aramark include the replacement of two gas boilers at Dr. Jorge Alvarez with two high-efficency condensing boilers in 2014, and steam trap replacement at Hope and Mount Pleasnt High Schools in 2013 and 2015. In 2013, Aramark also installed domestic hot water and condensate tank insulation at Mount Pleasant through a National Grid energy efficiency program.

LED Lighting Retrofits

Aramark electricians installed LEDs lighting in stairwells at Central, Hope, and Mount Pleasant High Schools through National Grid's upstream program in 2015. The Department of Public Property has scheduled the Classical, PCTA, Hope and Mount Pleasant high school buildings to be retrofitted with LEDs in 2016.

Public Safety

Public Safety buildings present considerable energy efficiency challenges due to the nature of their use. All of the City's fire stations, as well as the Public Safety Complex, are occupied twenty-four hours a day, seven days a week by emergency responders. The Providence Public Safety Complex, headquarters and central station for the Providence Police and Providence Fire Department, serves the City around the clock, 365 days a year.

At 2,969,400 kilowatts in FY 2015, the building used the most electricity of all the buildings in the City's portfolio. The Department of Telecommunications, the City's twenty-four hour 911 call center, like the City's fire and police stations, also needs to be operational twenty-four hours per day, seven days a week, contributing to that building's relatively high EUI.

Table 5: Public Safety Buildings Energy Performance and Benchmarking

Facility Public Safety Buildings	Year Built	Gross Floor Area (sq. ft.)	FY 2015 Electricity Use (kWh)	FY 2015 Natural Gas Use (therms)	FY 2015 Fuel Oil #2 (kBtu)	FY 2015 Total Site Energy Use (kBtu)	FY 2015 Direct GHG Emissions (Metric Tons CO2e)	FY 2010 Site EUI (kBtu/ft^2)	FY 2015 Site EUI (kBtu/ft^2)
							Averages:	103.2	117.3
Providence Police Academy	1928	20,175	33,011		1,593,072	1,705,706	118.2	90.6	84.5
Providence Emergency Management Agency	1991	12,776	160,001	3,427	241,362	1,130,014	36.1	42.1	88.4
Public Safety Complex	2002	119,002	2,942,692	20,581		12,098,536	109.3	131.6	101.7
Peter A. Rochio Substation*	2006	914	29,878			101,943		78.2	111.5
Department of Communications	1987	11,752	270,049	8,965		1,817,921	47.6	151	154.7
Steven M. Shaw District 5 Substation	1996	546	7,915	621		89,105	3.3	125.5	163.2

*Because the Peter A. Rocchio Police Substation uses only electric heat, there are no direct GHG emissions for that site to report.

Table 6: Fire Station Buildings Energy Performance and Benchmarking

Facility Fire Stations	Year Built	Gross Floor Area (sq. ft.)	FY 2015 Electricity Use (kWh)	FY 2015 Natural Gas Use (therms)	FY 2015 Fuel Oil #2 (kBtu)	FY 2015 Total Site Energy Use (kBtu)	FY 2015 Direct GHG Emissions (Metric Tons CO2e)	FY 2010 Site EUI (kBtu/ft^2)	FY 2015 Site EUI (kBtu/ft^2)
							Averages:	92.3	91.1
North Main Street Fire Station	1951	14,760	92,394	5,578		873,081	29.6	65.7	59.2
Messer Street Fire Station	1948	9,150	68,865	499	380,328	665,228	30.9	80.3	72.7
Branch Avenue Fire Station	1948	14,616	90,137	372	778,734	1,123,515	59.8	70.8	76.9
Hartford Avenue Fire Station	1948	9,150	52,919		582,636	763,196	43.2	89.2	83.4
Broad Street Fire Station	1942	9,426	70,434	939	453,744	787,981	38.7	91.1	83.6
Reservoir Avenue Fire Station	1932	7,360	48,755	536	407,376	627,364	33.1	79.6	85.2
Allens Avenue Fire Station	1948	9,440	45,540	6,486		803,941	34.4	101.3	85.2
Brook Street Fire Station	1950	7,580	51,328	5,320		707,131	28.3	85.6	93.3
Admiral Street Fire Station	1924	12,850	72,533	8,913	83,904	1,222,712	53.6	103.9	95.2
Atwells Avenue Fire Station	1948	10,022	62,233	527	705,594	970,601	55.2	79.8	96.8
Mount Pleasant Avenue Fire Station	1903	5,332	32,135	374	416,208	563,290	32.9	120.4	105.6
Humboldt Avenue Fire Station	1905	7,460	35,960		723,396	846,091	53.7	114.3	113.4
Rochambeau Avenue Fire Station	1928	7,400	38,994	8,524		985,447	45.3	118.3	133.2

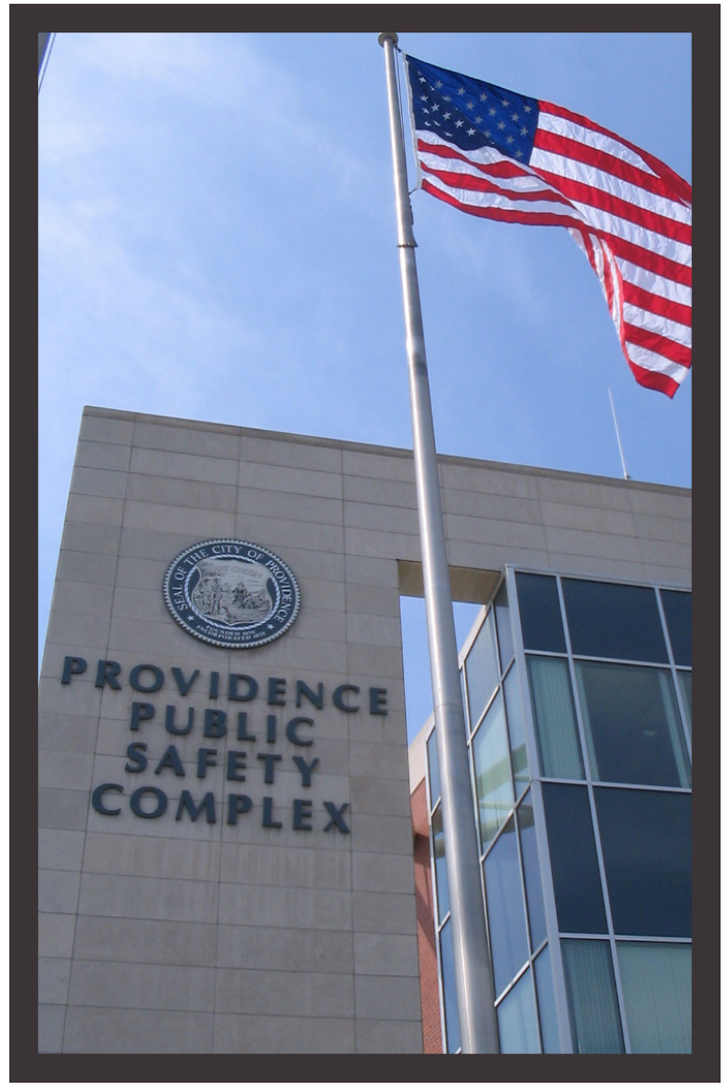
Energy Efficiency Improvements

Heating and Cooling System Upgrades

Conversions to gas heat, and other heating system upgrades between 2011 and 2012 at the Admiral Street, Allens Avenue and North Main Street fire stations have prevented nearly 440 tons of carbon emissions from entering the atmosphere and saved the City over $50,000. Renovations at the Allens Avenue Fire Station included boiler replacement, a new condensate tank, steam trap repair, and new exterior doors. The North Main Street Fire Station also had its antiquated boiler replaced, had new water pumps installed, and had two exterior doors replaced. The Admiral Street Fire Station's upgrades included a new gas burner and condensate tank, as well as steam trap repair and weather-tight exterior doors.

In 2014, The Department of Public Property entered into an energy performance contract with ENE Systems for the replacemnet of two roof-top air-conditioning units (RTUs) at the Providence Public Safety Complex. Cost data pulled from the Peregrine Focus energy management software shows that, in FY 2015, operational cost savings at the site has surpassed the $130,557 annual savings guaranteed by the contractor, and is poised for continued annual savings. Electric consumption at the site in FY 2015 was down 16% from the previous three-year avaerage. In addition to that project, ENE was also responsible for completeing the heating plant retrofits at the Alllens Avenue, Admiral Street and North Main Street Fire stations.

The City is currently exploring options for deep-energy retrofits at the Atwells Avenue, Broad Street, and Brach Avenue fire stations, as well as the Dexter Street Fire Department Garage and the City's Police Academy. The City has applied for the Rhode Island Infrastructure Bank's Efficient Buildings Fund for a low-interest loan to implement over $1 million in energy efficiency upgrades that are estimated to reduce energy consumption by over 40% and yield savings of over $100,000.



Administrative Offices

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. In late 2011, in a move to reduce energy and other City expenses, the Department of Inspections and Standards, and the Department of Planning and Development, along with several other City offices scattered throughout Providence, were moved from existing locations to a central site, the Joseph Doorley, Jr. Building, named for Providence's thirty-first mayor. The City currently leases this building.

With a current Energy Star score of 94, Providence City Hall is great example of how properly performed energy efficiency retrofitting measures can reduce building emissions and provide energy and cost savings. Conversion from oil to natural gas heat, heating system upgrades, and lighting retrofitting have resulted in an estimated energy cost savings of over $222,000 since FY 2012. Conversely, the Joseph A. Doorley, Jr. building's Energy Star score of 44 makes that building a priority target for future energy efficiency measures.

Table 7: Administration Buildings Energy Performance and Benchmarking

Facility Administration Buildings	Year Built	Gross Floor Area (sq. ft.)	FY 2015 Electricity Use (kWh)	FY 2015 Natural Gas Use (therms)	FY 2015 Fuel Oil #2 (kBtu)	FY 2015 Total Site Energy Use (kBtu)	FY 2015 Direct GHG Emissions (Metric Tons CO2e)	FY 2010 Site EUI (kBtu/ft^2)	FY 2015 Site EUI (kBtu/ft^2)	FY 2010 ENERGY STAR Score	FY 2015 ENERGY STAR Score	ENERGY STAR score Change
							Averages:	**84.2**	**92.3**	**60.8**	**63.6**	
City Hall	1855	99,675	563,778	44,959		6,419,490	238.8	86.1	64.4	77	94	↗
Dr. Robert F. Roberti Administration Building	1945	56,744	770,897	22,279		4,858,250	118.3	118	85.6	47	79	↗
DPW Administration Building	1925	20,511	52,105	16,890		1,866,782	89.7	41.5	91	94	72	↘
Joseph A. Doorley, Jr. Building*	1966	72,000	1,224,633	30,834		7,261,899	163.8		100.9		44	↗
The Family and Community Engagement Center	1960	8,700	82,253	6,124		893,012	32.5	99.8	102.6	25	29	↗
Department of Recreation**	2001	4,186	43,591		308,016	456,748	22.9	75.6	109.1			

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

**The Departmnet of Recreation building is not eligiable for an Energy Star score, due the fact that the total area of the building measures less than 5000 square feet.

Energy Efficiency Improvements

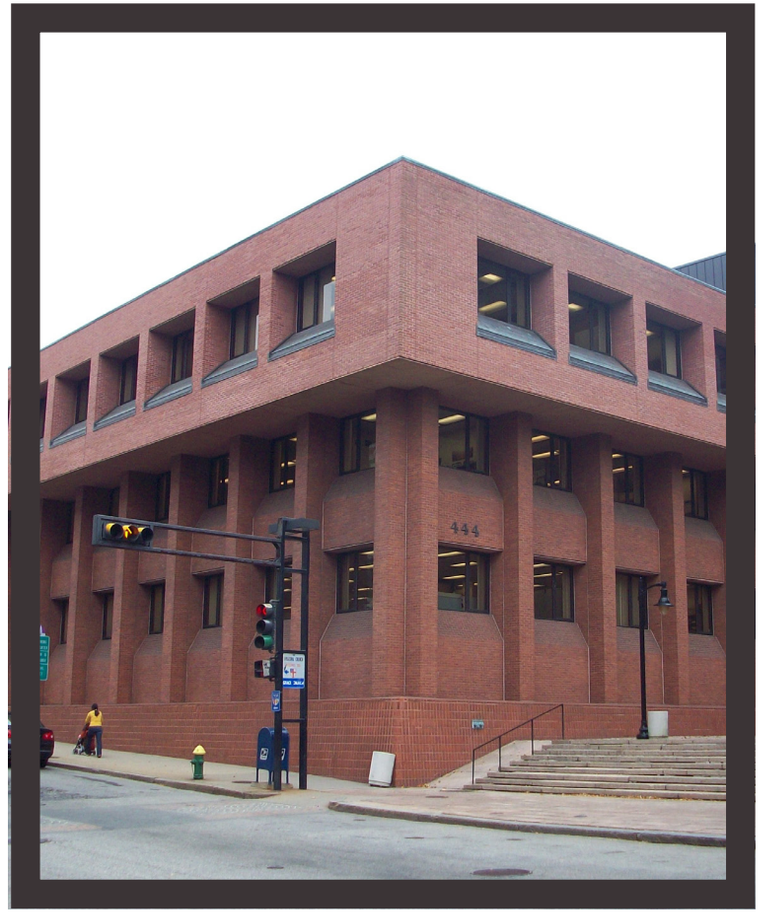
Heating and Cooling System Upgrades

The Department of Recreation's headquarters is the only facility remaining in this category that still uses #2 fuel oil. Aramark completed a number of upgrades at the Dr. Robert F. Roberti School Department Administration building in 2014 including the installation of two high-efficiency condensing boilers, four variable frequency HVAC fan drives, and high-high efficiency air-handling unit motors. In 2013, the City completed significant upgrades to City Hall's steam heat system including replacing the three existing antiquated boilers with two high-efficiency ones. Improvements also included the installation of vacuum condensate return system, new steam traps and valves, and an energy management system with remote monitoring capabilities. These upgrades have resulted in an annual $23,000 in City Hall energy cost savings.

LED Lighting Retrofits

In 2012, the Department of Public Property installed LED bulbs in all of the pendulum-style fixtures lining the building's hallways. By FY 2013, that measure alone had helped the City reduce its electricity use by 19,700 kWh. In FY 2015, the City purchased LED tubes for installation in City Hall offices in 2016. This was done through National Grid's upstream lighting program. The measure is expected to save the City $10,000 annually.

The Dr. Robert F. Roberti Administration Building has also been selected for an LED lighting retrofit in 2016. Savings at the office building is expected to reach about 64,798 kWh, annually.



Recreation Centers

Providence owns and operates eight neighborhood recreation centers. In addition to athletics, the City's recreation centers house a wide range of youth and family programs. While six of the centers operate out of their own facilities, the South Side and Joslin Recreation Centers, share space at two of the City's elementary school buildings, William D'Abate Elementary, and the B. Jae Clanton Educational Complex, respectively. Since the energy that the two centers used is a portion of that used by the elementary school buildings where they are headquartered, their EUIs do not appear in the table below.

Energy Efficiency Improvements

LED Lighting Retrofits

All of the City's recreation centers, including those sharing designated space in Providence school buildings, were retrofitted with energy efficient T8 fluorescent light bulbs in 2009. These sites have all been recently targeted by the Department of Public Property for new lighting retrofit projects incorporating the latest LED technologies.

Table 8: Recreation Center Buildings Energy Performance and Benchmarking

Facility Recreation Centers	Year Built	Gross Floor Area (sq. ft.)	FY 2015 Electricity Use (kWh)	FY 2015 Natural Gas Use (therms)	FY 2015 Fuel Oil #2 (kBtu)	FY 2015 Total Site Energy Use (kBtu)	FY 2015 Direct GHG Emissions (Metric Tons CO2e)	FY 2010 Site EUI (kBtu/ft^2)	FY 2015 Site EUI (kBtu/ft^2)
							Averages:	**82.4**	**92.4**
Vincent Brown Recreation Center	1997	18,111	30,005	9,526		1,054,977	50.6	52.5	58.3
West End Recreation Center	1997	25,760	155,883	9,853		1,517,147	52.3	53.2	58.9
Neutaconkanut Recreation Center	1997	15,345	51,137	10,319		1,206,388	54.8	82.5	78.6
Zuccolo Recreation Center	1949	11,592	59,278	7,271		929,385	38.6	77.8	80.2
Davey Lopes Recreation Center	1948	11,860	74,149	13,059		1,558,914	69.4	142.6	131.4
Selim Madelin Rogers Recreation Center	2000	9,350	74,285	11,211		1,374,570	59.5	85.9	147

Department of Public Works and Other Buildings

Across the street from the City's Department of Public Works Administration Building, are two large structures housing the work force, trucks, and equipment and tools necessary to keep Providence's infrastructure in good repair. The Traffic and Engineering building and the airport-hanger like structure affectionately known by City workers as "The Roller Shed" also rely on the energy purchased by the City. The Dexter Street Garage is where all City-owned police and fire vehicles are sent for repairs.

Table 9: Miscellaneous Buildings Energy Performance and Benchmarking

Facility DPW & Other Buildings	Year Built	Gross Floor Area (sq. ft.)	FY 2015 Electricity Use (kWh)	FY 2015 Natural Gas Use (therms)	FY 2015 Fuel Oil #2 (kBtu)	FY 2015 Total Site Energy Use (kBtu)	FY 2015 Direct GHG Emissions (Metric Tons CO2e)	FY 2010 Site EUI (kBtu/ft^2)	FY 2015 Site EUI (kBtu/ft^2)	FY 2010 ENERGY STAR Score	FY 2015 ENERGY STAR Score	ENERGY STAR score Change
							Averages:	**60.3**	**55.9**			
DPW Maintenance, Traffic and Roller Shed	1930	117,618	286,274	81,982		9,174,981	435.4	90	78			
Dexter Street Garage	1905	17,000	117,951	24	1,368,132	1,772,937	101.7	103.5	104.3			
Public Safety Garage*	2002	162,976	227,618			776,631		4.8	4.8			
Asa Messer Annex (WSPS)	1925	20,360	18,489	7,845		847,584	41.7	42.5	41.6	82	94	↗
Windmill Annex (A Venture)	1930	25,060	60,459	11,710		1,377,291	62.2	46.7	55	91	76	↘
Central Supply Providence Schools	2004	15,525	93,174	8,068		1,124,751	42.9	118.3	72.4	3	16	↗
Oliver Hazard Perry (Providence Mayoral Academy ES)	1929	182,488	293,189	118,772		12,877,524	630.9	49.4	70.6	33	10	↘
Lillian Feinstein Senior Center	2001	8,520	40,471	3,270		465,099	17.4	35.1	54.6			
Camp Cronin*	1960	4,362	30,164			102,919		2.3	21.9			
Alex and Ani City Skating Center**	1999	6,373	520,299	9,429		2,718,160	50.1					
Dalrymple Boat House	1894	17,474	66,221		460,368	686,315	34.2	36	39.3			
Museum of Natural History and Planetarium	1894	19,500	235,499		1,033,068	1,836,591	76.7	104.4	94.2			
The Casino at Roger Williams Park	1894	16,782	257,594	9,572		1,836,117	50.8	86.5	109.4			
Windmill Street School (closed)	1915	86,140	65,971	14	2,940,228	3,166,721	218.3	65	36.8			

*Because the the Public Safefty Garage and Camp Cronin use only electric heat, there are no direct GHG emissions for those sites to report.

** The Alex and Ani City Skating Center's EUI has yet to be calculated, pending verification of the facility's total area (sq. ft.).

Energy Efficiency Improvements

Heating and Cooling System Upgrades

The heating plant at the Department of Public Works' roller shed and traffic engineering buildings was completely redesigned by ENE Systems. The measures included switching to natural gas from oil, removal of the buildings' shared antiquated steam heat system, installation of condensing space heaters and infrared heating units, and the installation of an energy management system with remote monitoring. Annual cost savings at the site, projected at $43,840, has actually exceeded nearly $70,000 annually.

LED Lighting Retrofits

In October of 2015, the Department of Public Property applied incentives available from National Grid's upstream LED lighting program to offset the costs of upgrading lighting in the park zoo. The estimated annual operational savings is expected to reach $14,858.

Lighting at the Providence Public Safety Complex's parking garage was also upgraded to LEDs in 2015. In December, 375 existing 32-watt T8 florescent tubes at the facility were replaced with 12-watt LED tubes. National Grid provided LED upstream lighting program incentives for the project that is expected to net $7,862 in savings.

Outdoor Lighting

Street lighting, floodlighting for parks and schools, and decorative sidewalk lighting accounted for 37% of the City's total electricity use in FY 2015, and accounted for 52% of its total $9,214,239 electricity cost. Providence's 16,800 cobra-style high pressure sodium (HPS) streetlights represent the majority of the municipal outdoor lighting load, about 17.6 million kWh, annually.

Unlike Providence's decorative sidewalk lamps, which the City owns, Providence's streetlights were owned and maintained by the electric company, Narragansett Electric (acquired by National Grid in 2000) until 2016. In addition to electric distribution charges, costly maintenance charges, known as "facility" charges, were also billed to the City for the roadway lamps. These charges, about $138 annually per fixture, and totaling about $2.3 million a year, are some of the cost the City hopes to alleviate through its collaboration with the Partnership for Rhode Island Streetlight Management (PRISM).

In 2014, the Department of Public Property began working with PRISM, a non-profit statewide program spearheaded by Rhode Island's Washington County Regional Planning Council (WCRPC), to significantly lower the costs of this City service. PRISM's advocacy was instrumental in the adoption of State law RIGL 39-30, which enables cities and towns to purchase and upgrade their streetlights.

In June 2015, PRISM presented a report projecting $1,499,131 in annual savings should the City purchase the streetlights from National Grid, and contract with PRISM for the management and maintenance thereof. The report went on to show that converting the existing HPS lamps to LED's would result in an additional $1,801,901 in yearly savings. Furthermore, the report stated that if the City installed intelligent lighting controls, as opposed to the standard photo sensors, and if streetlights were dimmed between 11:00pm and 5:00am, another $146,997 in annual savings to the City could be realized.

In FY 2015, Providence streetlights used 17.8 million kWh. PRISM projections for total kWh use for City streetlights after acquisition and LED retrofitting are 3.9 million kWh, a reduction of 13.9 million kWh. The high-profile measure will reduce City indirect GHG emissions by 10,566 tons of CO_2e, the same amount of GHGs emitted by 2,018 cars in one year.

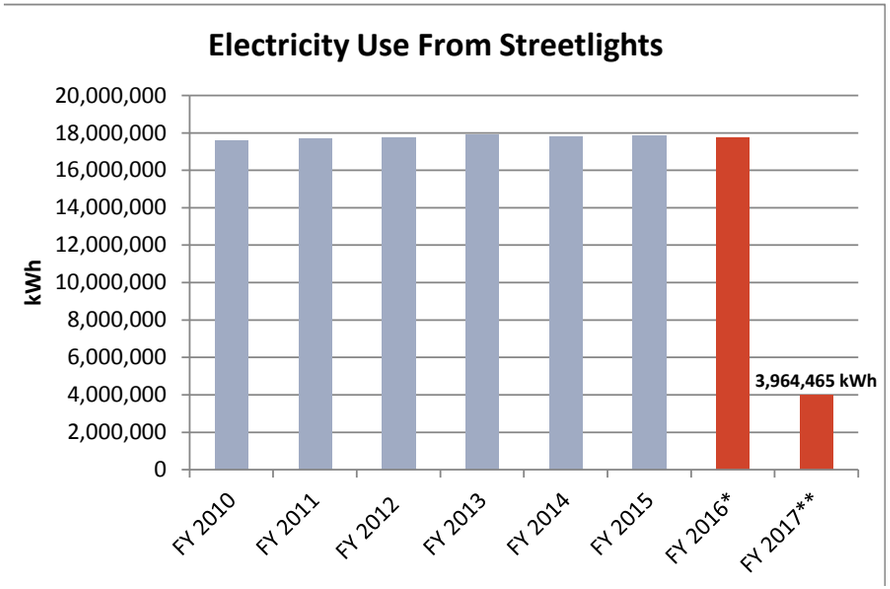


Figure 10: Electricity use from Providence's streetlights, 2010 - 2014. This graph also includes project consumption for 2016 and 2017. By 2017, the City plans to have all 16,800 streetlights converted to high-efficiency LEDs, which will reduce consumption by roughly 75%.
*Projected **Post LED Retrofit

Table 10: Estimated savings from three streetlight project proposals

	City Leased Streetlighting (Current)	City Streetlight Acquisition Only	Acquisition and Conversion to LED	Acquisition, LED Conversion, and Intelligent Controls
Distribution & Maintenance	$3,057,816	$1,558,685	$563,640	$562,648
Electricity Supply	$1,114,082	$1,114,082	$307,227	$161,222
Total Cost	$4,171,898	$2,672,767	$870,867	$723,870
Annual Savings		$1,499,131	$3,301,031	$3,448,028

Renewable Energy

Investments in renewable energy is a critical strategy for the City to achieve its goal to reduce energy consumption 30% by 2030. Energy savings can be realized by energy efficiency or by switching to renewables. By switching to renewables, the City aims to also diversify and stabilize its energy supply and associated costs.

In 2014 Providence commissioned a photovoltaic (PV) solar feasibility study to evaluate the technical and financial viability of solar projects at City buildings. The report, by Northeast Engineers & Consultants, Inc., detailed findings on twenty City-owned buildings including the Public Safety Complex, DPW, City Hall and thirteen schools. The study cited nearly all the schools included in the report as viable candidates for the Renewable Energy at Rhode Island Schools Grant.

Following the completion of the study, the City released a request for qualifications to move ahead with solar PV installations on the buildings with the highest solar potential. The City hopes to implement solar PV 5 buildings in FY 2017 via a power purchase agreement. This agreement means that a third party will own and operate the systems and the City will purchase the energy from their production at a discounted and locked-in rate over the course of 20 years.

Tier	Name	PV Size*, kW	EPP*, MWh/yr	Qual. Score
I	Dr. Jorge Alvarez High School	460	574	1.7
	Public Safety Complex	250	316	1.7
	Providence Career and Technical Academy	530	662	2.2
II	Mt. Pleasant High School	180	226	2.2
	Nathaniel Greene Middle	70	88	2.2
	Nathan Bishop Middle School	130	163	2.2
	Pleasant View Elementary	190	198	1.9
	George J. West Elementary	180	226	2.2
	Carl G. Lauro Elementary School	180	225	2.2
	Providence Schools Administration	90	113	2.2
	Providence Emergency Management Agency	5	6	2.2
	Public Safety Complex Garage	140	175	1.9
III	Classical High School	560	702	0.7
	Department of Public Works	370	422	1.4
	DPW Traffic Engineering	410	514	0.7
IV	Hope High School	150	188	1.5
	Roger Williams Middle School	70	88	1.2
	Esek Hopkins Middle School	30	38	1.2
	Gilbert Stuart Middle School	80	100	1.2
	Providence City Hall	10	13	1.2

Note: *Estimated PV size and EPP were calculated for relative ranking purposes only. Actual figures based on detailed design calculations will vary.