



Providence Energy Efficiency Case Study

Providence, Rhode Island

Project Overview

Energy efficiency programs and policies originate at the local level in an effort to spur economic growth, energy security and climate protection. Throughout the region cities have become the forefront for local climate action by working towards sustainable cities and built environments. The City of Providence, Rhode Island has spearheaded energy efficiency programs. "With buildings accounting for roughly 70 percent of carbon emissions in Providence, City government is leading by example with its goal to reduce energy consumption in City buildings 30 percent by 2030," said Mayor Elorza. The City can achieve this goal through energy efficiency improvements and by switching to renewable energy sources. This will help diversify and stabilize energy supply and the associated costs. Providence has been very transparent in their efforts by releasing the Providence Municipal Energy Report, which discloses the City's energy data in an effort to track the City's progress in meeting their energy goals. For the City, measuring and monitoring consumption by benchmarking buildings is key in achieving their goals. Benchmarking is not new to the City, Providence has been benchmarking and monitoring energy consumption since 2010 by using the U.S. EPA Energy Star Portfolio Manager to track electric, gas, oil, and water consumption. Mayor Elorza stated, "By benchmarking our buildings' energy consumption, investing in energy efficiency, and reporting the results to the public, we aim to serve as a model for residents and businesses by encouraging all industries to work together to address global climate change." In addition to [the report](#), the City of Providence Office of Sustainability has also published a table of [high priority actions](#) with a 2016 status update and future milestones.

Providence has become one of the nation's leading municipalities by benchmarking and publicizing annual energy reports.



In Fiscal Year (FY) 2015, Providence used 52,700,036 kWh of electricity, which is a four percent reduction from the FY 2010 baseline. Additionally, in FY 2015, the City's municipal greenhouse gas emissions declined by 11% from 41,664 tons in FY 2010, to 37,038 tons. This decrease is largely due to the switch from coal and oil to natural gas for thermal energy and electricity. There were many other contributing accomplishments as well, such as lighting retrofits at schools and municipal-use buildings, heating and cooling improvements, and more efficient electronics and appliances.

As a result of the advancements made in the Rhode Island Energy Conservation Code, newer buildings owned by the City have incorporated more advanced lighting, HVAC technologies, and efficiency guidelines. In particular, the City used the 2013 sixth edition of the Rhode Island Energy Conservation Code, which aligns with the 2012 International Energy Conservation Code. Understanding building use-type helps understand energy needs and to determine appropriate upgrades. Schools, public safety buildings, and administrative buildings have different use purposes, and required diverse energy efficiency upgrades. Outdoor lighting has also been a major helping hand in reaching the City's goals.



Highlights

- Approximately one-third (15 out of 43) **Energy Star buildings qualify for certification**, performing better than more than 75% of similar buildings.
- Greenhouse gas emissions from municipal buildings and outdoor lighting have gone down **11% since 2005**, largely due to fuel switching.
- Investments in lighting and mechanical efficiency measures have **reduced electricity consumption by roughly five percent** since 2010.
- 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**.
- 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 city has implemented fuel-switching technology, **replacing oil-burning furnaces** with more affordable and cleaner-burning natural gas.

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. The schools' roughly 4.2 million square feet of space accounts for 76% of the City's building portfolio, making schools a priority due to their massive municipal energy usage. In Fiscal Year 2015, schools used 313,548 of the 492,916 MBtu (64 percent) of combined electric, oil and gas used by the city.

This is because schools tend to have high occupancy rates and long operational hours with after school activities such as athletics and community programs, making them intensive energy consumers compared to other municipal buildings. Schools have been increasingly supplied with computers and electronic technology, driving up energy consumption, so the City is working on new cost-effective programs and software to evaluate energy data and reduce energy waste.



Areas of Focus

- **Building Management System (BMS) Upgrades**
 - Aramark has completed 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.
 - Alan Shawn Feinstein Elementary at Broad Street is the City's oldest school, built in 1895, with a 2015 Energy Star scores of 81, making it eligible for certification.
 - Robert L. Bailey, IV Elementary School, built in 2000, has the highest Energy Star score for 2015 at 95.
- **Heating and Cooling system upgrades**
 - Heating system steam traps 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.
 - #1 boiler at Gilbert Stuart Middle School was replaced, with the addition of new gas distribution controls. Two gas boilers were replaced at Dr. Jorge Alvarez with two high-efficiency condensing boilers in 2014, and steam trap replacement at Hope and Mount Pleasant High Schools in 2013 and 2015.
- **LED Lighting Retrofits**
 - In 2016, fifteen LED retrofits are planned for City schools. This is expected to save roughly 2,443,306 kWh of electricity, reducing GHG emissions by about 1,857 tons.
 - 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 GHG from escaping into the atmosphere. These measures are expected to save the City approximately \$390,929 annually.
 - Four elementary and two high schools have had their stairwell lighting retrofitted with LED fixtures through National Grid's upstream program.

Schools in Providence are taking the next step in becoming high performing by getting verified as a Northeast Collaborative for High Performance Schools (NE CHPS). NE CHPS is a guide for creating sustainable, efficient, healthy, learning environments. The criteria contains categories including integrated planning, energy efficiency, water efficiency, indoor environmental quality, site selection and layout, and sustainable materials management. Two exemplars of high performing schools in Providence include the **Nathan Bishop Middle School** and the **Providence Career and Technical Academy**.





The **Nathan Bishop Middle School** is an example of a historic building becoming high performing. Built in 1929, in Georgian Revival Style, it was one of the first projects to apply the NE CHPS criteria in the region. A collaborative team was formed to achieve deep energy efficiency, indoor environmental quality, water efficiency improvements with the inclusion of sustainable materials. In doing so, the school was able to come off the Most Endangered Properties List in 2009. The collaborative team included the City of Providence, School Department, East Side Community, Providence Preservation, RIDE, and a professional team.



The **Providence Career and Technical Academy** is a school that was designed as an interactive learning laboratory. The project was approved in December of 2007 and completed by an energy service company. The integrated project benefits include an expanded curriculum, high capacity levels, a school as a tool for learning, and large cost savings. This school received 24 points on the NE CHPS criteria.

Highlights

- 40% energy savings over a comparable baseline building that meets ASHRAE standards
- Over \$90,000 savings in annual operating costs
- 20,000 gallon rainwater collection system for toilet flushing
- Recycle reuse and/or salvage of over 50% of non-hazardous construction and demolition waste
- 100% of classrooms have access to views and day lighting strategies

Highlights

- Solar thermal hot water collectors produce 30% of annual hot water demand
- Subsurface Stormwater Retention Infiltration system
- No potable water is used to irrigate landscape
- Demonstration wind turbine
- Views to outside from regularly occupied spaces
- Sustainable site with alternative transportation options such as biking and public transportation
- CO₂ optimizing HVAC controls



Public Safety Buildings

Public safety buildings can be more difficult when it comes to energy efficiency because a majority of them are in operation 24 hours, 7 days a week. The Providence Public Safety Complex, all the City's fire stations, and the headquarters and central station for the Providence Police and Providence Fire Department, serve the City around the clock. The Department of Telecommunications, the City's twenty-four hour 911 call center, is also located in the Public Safety Complex. There are different challenges faced when making energy efficient improvements to public safety buildings. A public safety building, such as a fire station, uses more energy for heating and cooling because the garage doors open and close frequently. In Fiscal Year 2015 the Public Safety Complex used the most electricity of all the buildings in the City's portfolio at 2,969,400 kilowatts.

Areas of Focus

- **Heating and Cooling system upgrades**
 - Renovations at the Allens Avenue Fire Station include boiler replacement, a new condensate tank, steam trap repair, and new exterior doors. Savings include 440 tons of carbon and \$50,000+
 - North Main Street Fire Station: antiquated boiler replaced, new water pumps installed, and two exterior doors replaced
 - Admiral Street Fire Station: new gas burner and condensate tank, and a steam trap repair and weather tight exterior doors put in.
 - Savings from the Allen Avenue, North Main Street, and Admiral Street Fire stations include 440 tons of carbon and \$50,000+
 - In 2014, The Dept. of Public Property entered a contract with ENE Systems to replace of two roof-top air-conditioning units at the Providence Public Safety Complex. In FY 2015, electric consumption was down 16 percent from previous 33-year average.
 - Five deep-energy retrofits-- Using the Rhode Island Infrastructure Bank's (RIIB) Efficient Building Fund (EBF) to invest \$1 million in 5 buildings for deep energy retrofits that will result in energy savings of over 40%.
- **LED Lighting Retrofits**
 - The Public Safety Complex parking garage was upgraded in 2015. 375 existing 32-watt T8 florescent tubes were replaced with 12-watt LED tubes. Net savings of \$7,862 are expected

Table 5: Public Safety Buildings Energy Performance and Benchmarking

| Facility | 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) |
|--|------------|----------------------------|-------------------------------|----------------------------------|----------------------------|--------------------------------------|---|--|--|
| Public Safety Buildings | | | | | | | 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. Rocchio 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.



Administrative Offices

The City Hall is home to the Mayor's Office, Public Property, Human Resources, Retirement Office, Tax Assessor, the Office of Sustainability, and more. Providence City Hall has a current Energy Star score of 94. 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 between FY 2012 and FY 2015. In 2013, the City installed two high-efficiency antiquated boilers, replacing three old ones. Other improvements include installation of vacuum condensate return system, new steam traps and valves, and an energy management system with remote monitoring capabilities. These improvements have resulted in \$23,000 energy cost savings. In an effort to further reduce energy and other City expenses, the Department of Inspections and Standards, and the Department of Planning and Development, along with other City offices scattered throughout Providence, were moved from existing locations to a central site, the Joseph Doorley, Jr. Building. The City is currently leasing this building, and with its low Energy Star Score of 44, it is a priority in future energy efficiency targets.



Areas of Focus

- **Heating and Cooling System Upgrades**
 - Dr. Robert F. Roberti School Dept. Administration building upgrade in 2014 included installation of two high-efficiency condensing boilers, four variable frequency HVAC fan drives, and high-high efficiency air-handling unit motors.
- **LED Lighting Retrofits**
 - In 2012, LED bulbs were installed in all the pendulum-style fixtures lining City Hall's hallways, reducing electricity usage by 19,700 kWh by FY 2013.
 - In 2016, LED tubes for City Hall offices have been installed through National Grid's upstream lighting program and is expected to save the City \$10,000 annually
 - LED lighting retrofits in the Dr. Roberti Administration Building were done in 2016, expecting to reach savings of about 64,798 kWh annually.



Street Lights

Within Providence City borders, 16,800 streetlights are being replaced with light-emitting diodes (LEDs). The City is purchasing the street lights from National Grid and will replace the old “cobra head” high-pressure sodium-vapor light fixtures with ones that hold LEDs. The switch to LED street lights has many benefits, including reduced maintenance costs, reduced energy costs and greenhouse gas emissions, a longer lifecycle, and better quality light. With a reduced maintenance cost and \$1.7 million in electricity savings, the switch to LEDs will make the City eligible for up to \$2.5 million in energy-conservation rebates in late 2016. Providence will be the biggest municipality in the state lit by LEDs. Providence’s street lighting plan has been made possible by the state’s Municipal Streetlight Investment Act, a 2013 law that allows cities and towns to buy streetlights from utility companies and maintain complete control over the maintenance of the lights.

- 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

Under contract with PRISM to purchase and convert all streetlights to LEDs with dimmable controls, the City is expecting the following savings following completion of the project in 2017.

- Expected cost savings: \$3.3 million;
- Expected KWH savings: 13.7 kWh;
- Expected CO₂ savings: 8,500-9,400 metric tons of CO₂

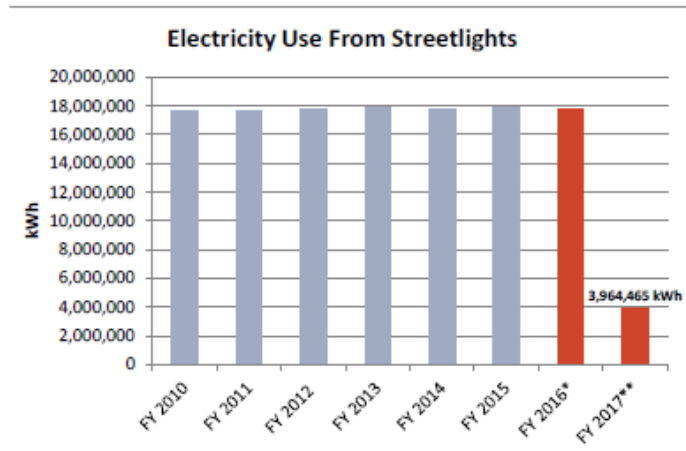


Figure 10: Electricity use from Providence's streetlights, 2010 - 2014. This graph also includes project consumption for 2016 and 2017. By 2017, the City plans to have all 16,800 streetlights converted to high-efficiency LEDs, which will reduce consumption by roughly 75%.
*Projected **Post LED Retrofit



Renewable Energy

In 2016, the City has promoted WBNA's Solarize Programs and launched a municipal Solarize program with Rhode Island Office of Energy Resources. The [Solarize RI](#) campaign aims to encourage homeowners and businesses to install solar panels, incentivized through a tiered pricing structure. Thus far the program has resulted in over 30 contracts signed that will increase installed capacity in Providence by 200 kW. Other priorities with renewables in Providence include:

- Establish tax assessment policies that incentivize renewable energy.
- Install renewable energy on city-owned properties. In 2016 an RFP was released for solar development and the City aims to have 1 MW by the end of 2017

Conclusion

Providence Rhode Island has taken a well-rounded approach to energy efficiency programs and policies at the local level. The approach taken by the City has led the way in creating innovative energy-efficiency programs that have cut customers' energy costs, driven the local economy and benefited the environment. Under Mayor Elorza's continued leadership on economic and environmental responsibility, the City of Providence is one of the nation's leading municipalities in energy efficiency by benchmarking its buildings and publicizing annual energy reports. Through benchmarking and publicizing reports, the City has set a standard residents and businesses can use to work collaboratively on achieving the goal of reducing the City's GHG emissions by 30 percent by 2030. Transparent leadership by the City of Providence has fostered a culture of trust between city officials, residents, and businesses. By publishing an annual report, each stakeholder involved in achieving the 2030 target can understand the City's vision and how their efforts help achieve city-wide goals. In addition, it keeps stakeholders engaged and increases accountability. Providence has already taken great strides towards reaching their goal. In 2015, Providence's use of electricity went down 4 percent from 2010 levels to 52,700,036 kWh of electricity. Additionally, in 2015, the City's municipal GHG emissions declined by 11% from 41,664 tons in 2010, to 37,038 tons. This has been done through fuel switching, investing in renewable energy and LED street lights, and understanding the different use-types of public buildings in the City's portfolio. As Providence continues to monitor its energy consumption and identify new opportunities for savings, the City is well on its way to meeting its goal by 2030.

For more information or if you have any questions about this case study, contact John Balfe, High Performance Buildings Associate, at (781) 860-7177 x109 or jbalf@neep.org.