



Hartford Public Schools

Facilities Benchmarking Analysis

*Utilizing the
US Environmental Protection Agency's
Energy Star - Portfolio Manager
October 2014*

Hartford Public Schools
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Conducted by:
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About Us

The Institute for Sustainable Energy

The Institute for Sustainable Energy at Eastern Connecticut State University was established in 2001 “to identify, develop and become an objective energy and educational resource regarding the means for achieving a sustainable energy future for Connecticut.” The Institute focuses on matters relating to public policy, energy education, energy efficiency, conservation and load management, efficient and renewable distributed generation, protection of environmental resources, and the dissemination of useful information on energy alternatives and sustainability to users and providers of energy. The Institute adds an unbiased focus on practical applications and broadcasting of information about how to improve the energy profile and sustainability of the region. It also provides programs and information to schools and businesses throughout the state that are dedicated to advancing environmental sustainability.

The Institute for Sustainable Energy provides local communities with assistance in planning for a more sustainable energy future. This work is done with support from the Connecticut Energy Efficiency Fund and in close collaboration with [EnergizeCT](#) programs. More information may be obtained from the [Institute for Sustainable Energy's website](#) or by calling the Institute at (860) 465-0251.

I. Hartford Public Schools Benchmarking Study

A. Overview

This report is a benchmarking analysis requested by the Hartford Public School System to evaluate the energy efficiency of their facilities. The benchmarking analysis performed by the Institute is designed to improve the understanding of the overall energy efficiency and consumption rates of the facilities, provide a baseline to track energy consumption in the future, and encourage environmentally sound energy management practices. The benchmarking report provides direction for targeting the Hartford Public Schools' limited capital improvement funds. By identifying the most energy-intensive facilities, it also identifies the need for improved operation and maintenance procedures.

The comparative energy consumption and benchmark scores for each school were calculated from data collected from energy bills and from information provided by Claudio Bazzano, Executive Director of Facilities. The schools were measured against the benchmarks set for K-12 schools within the US Environmental Protection Agency's (EPA) Energy Star "Portfolio Manager" software. The results can be viewed at www.EnergyStar.gov by clicking on **Portfolio Manager Login** in the **Business Improvement** section.

Username: HartfordPublicSchools

Password: Hartford-CT

This energy data can be used to further assess energy use, to achieve Energy Star building recognition, and to maximize energy and economic efficiency. Targeted improvements will lead to more economically efficient buildings that are also more environmentally sound.

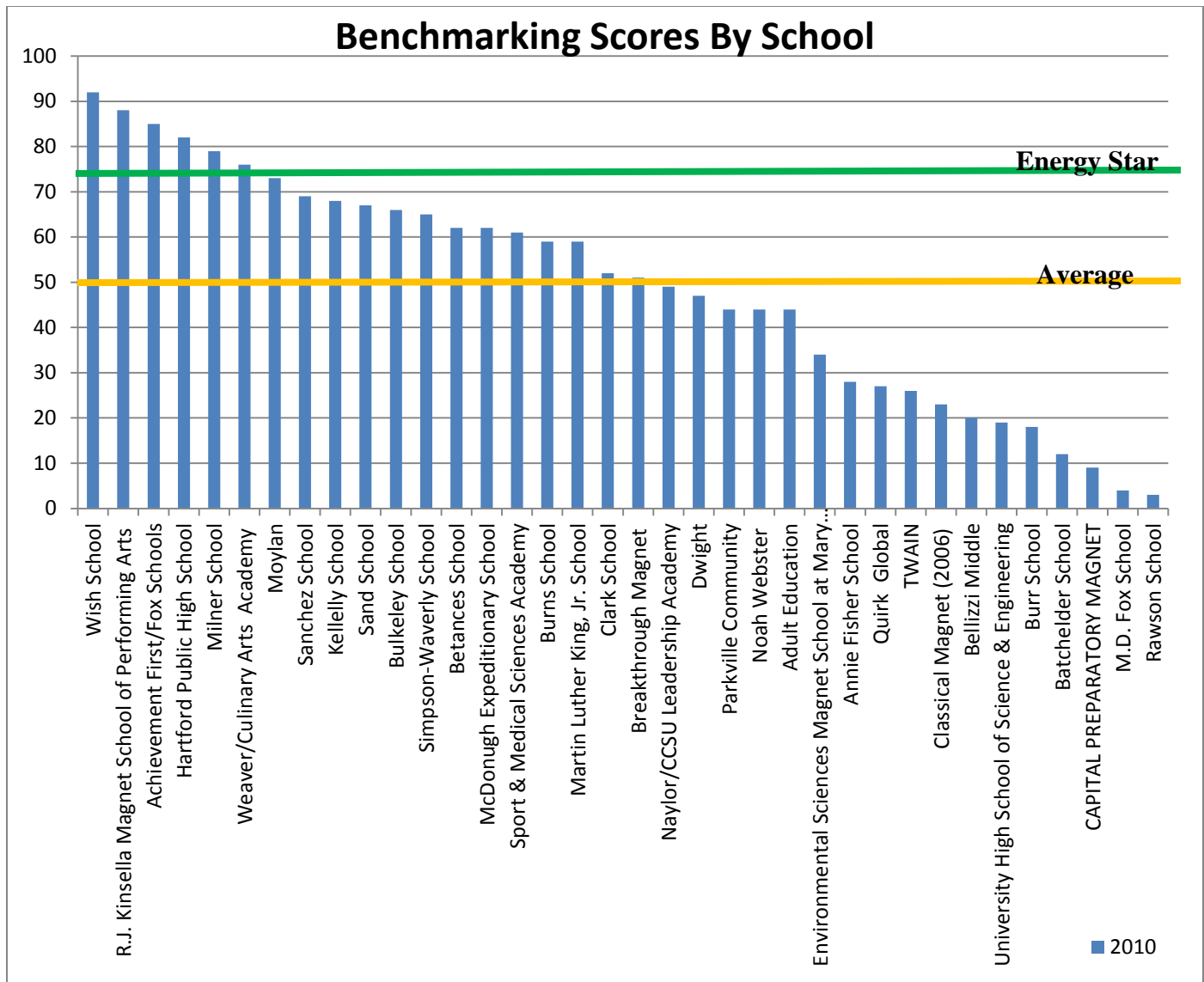
This report was compiled by the staff and student interns at the Institute for Sustainable Energy at Eastern Connecticut State University for the Hartford Public Schools. Its sole purpose is to help school officials better understand how energy is utilized in their facilities as compared to similar facilities. For more information about the Institute for Sustainable Energy at Eastern Connecticut State University, visit <http://www1.easternct.edu/sustainenergy/> or call the Institute of Sustainable Energy at (860) 465-0251.

B. Findings

This benchmarking analysis evaluates the energy use and demographic information of 34 Hartford public schools and determines their benchmarking scores. This analysis categorizes buildings according to three energy efficiency levels. These categories are indicative of the relative efficiency of the facilities as compared to peer facilities evaluated by EPA's Energy Star benchmarking tool and the Energy Information Services (EIS) database of the Department of Energy. The scoring also indicates a building's eligibility for recognition from the EPA through the Energy Star K-12 Public Schools building category.

Categories for recognition include:

- | | |
|--|---------------------------------------|
| 1. Eligibility for Energy Star recognition: | Rating of 75 or higher |
| 2. Preliminarily ineligible but improvable: | Rates between 50 to 74 |
| 3. Preliminarily ineligible with indicated need for additional technical review: | Ratings between 0 to 49 |



The table below gives a detailed breakdown of energy use and cost for each individual school and summary information and averages for schools within the school system. Scores are adjusted and normalized based on age of building, number of occupants, hours of use, and regional climate. Annual energy consumption is expressed in thousand British thermal units (kBtu) and includes electricity, fuel oil, and natural gas use and any onsite renewable energy production.

Benchmarking Results as of the 2009-2010 Fiscal Year

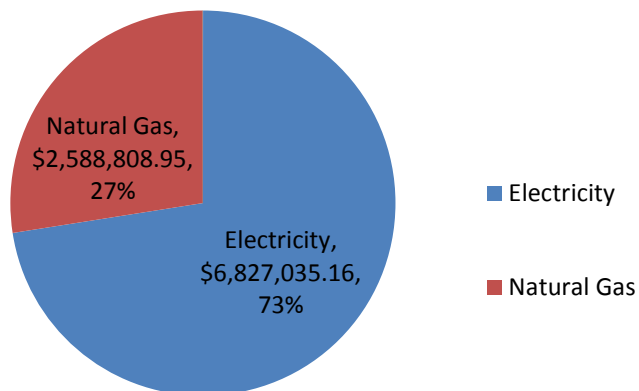
	Score	Annual Consumption		Site Intensity	Cost/sq. ft.	Floor Space	Year
SCHOOL		\$	kBtu	kBtu/sq. ft.	\$	(sq ft)	Built
CAPITAL PREPARATORY MAGNET	9	\$ 99,524	7,292,876	74.2	1.01	98245	2010
Batchelder School	12	\$ 206,355	10,541,935	109.8	2.13	96718	1958
Betances School	62	\$ 151,103	5,235,425	68.9	1.99	75980	1924
Burns School	59	\$ 180,501	12,215,784	72.8	1.69	109850	1939
Burr School	18	\$ 391,916	7,045,204	111.2	3.51	111212	1914
Clark School	52	\$ 236,669	5,152,,641	49.5	2.28	104004	1971
Dwight School	47	\$ 78,736	4,626,457	76	1.29	60869	1883
M.D.Fox Schools	4	\$ 427,223	19,745,355	128.9	3.27	130000	1924
Fisher Schools (Achievement First schools, WMA)	28	\$ 218,384	9,244,777	79.2	1.87	116680	1965
Mary Hooker Schools	34	\$ 225,359	6,329,627	59	2.11	106604	1952
Kennelly School	68	\$ 186,750	6,475,829	62	2.1	89376	1900
M.L. King Schools	59	\$ 344,470	16,619,705	75.6	2.27	152000	1924
R.J. Kinsella Schools (Gr. PK-8 & 9-10)	88	\$ 254,942	2,914,694	27.5	2.03	106000	1974
McDonough Schools	62	\$ 168,343	5,472,966	69.2	2.00	84100	1987
Milner School	79	\$ 197,277	6,928,653	53.3	2.11	93432	1924
Moylan school	73	\$ 340,077	9,646,938	68	2.40	141875	1930
Naylor/CCSU Leadership Academy	49	\$ 261,984	5,331,885	45.5	2.23	117098	1934
Parkville School	44	\$ 245,325	10,768,694	83.2	3.57	96691	1977
Rawson School	3	\$ 313,153	10,127,118	92.4	2.85	109613	1921
Sanchez School	69	\$ 232,885	8,436,185	51.3	1.77	130360	1992
Sand School	67	\$ 175,969	5,794,804	57.3	2.14	81684	1998
Simpson-Waverly School	65	\$ 214,464	5,645,334	54.1	2.06	104275	1970
Breakthrough II/Twain School	26	\$ 149,725	7,739,441	92.5	2.14	70000	1952
Webster School	44	\$ 131,080	6,475,631	56.4	1.12	117540	1900
Museum Academy at Wish	92	\$ 65,541	8,078,044	38.8	0.73	90402	1952
Fox/Achievement First Middle	85	\$ 399,265	8,323,791	37.9	1.82	219800	1971

	Score	Annual Consumption		Site Intensity	Cost/sq. ft.	Floor Space	Year
SCHOOL		\$	kBtu	kBtu/sq. ft.	\$	(sq ft)	Built
Quirk/Global Schools	27	\$ 466,435	20,209,531	94.7	3.27	143000	1972
Bellizzi/Asian Studies Academy	20	\$ 245,565	9,436,538	89.1	1.96	125400	1962
Bulkeley Schools (upper&lower)	66	\$ 749,121	34,319,083	66.8	2.50	299300	1974
Weaver/Culinary Arts Academy	76	\$ 879,825	29,278,652	64.6	2.30	382250	1974
Hartford Public High School	82	\$ 894,197	22,510,547	51.6	2.02	441145	1963
Adult Education	44	\$ 119,767	6,305,873	95.5	1.81	66000	1992
Breakthrough Magnet (South Campus)	51	\$ 201,375	4,997,524	84.5	3.41	59128	2005
University High School	19	\$ 194,836	5,809,536	64	2.14	90774	2010
Sport & Medical Sciences Academy	61	\$ 311,751	7,742,000	49.1	1.97	158000	2009
Classical magnet	23	\$ 368,450	10,316,698	71.7	2.56	143887	2006
Renzulli Gifted & Talented Academy	N/A *	Inc	Inc			25800	1972
Totals		\$ 9,448,121	341,856,900			4488631	
Averages		\$ 255,355	9,239,376	66.4	\$2.05	121314	

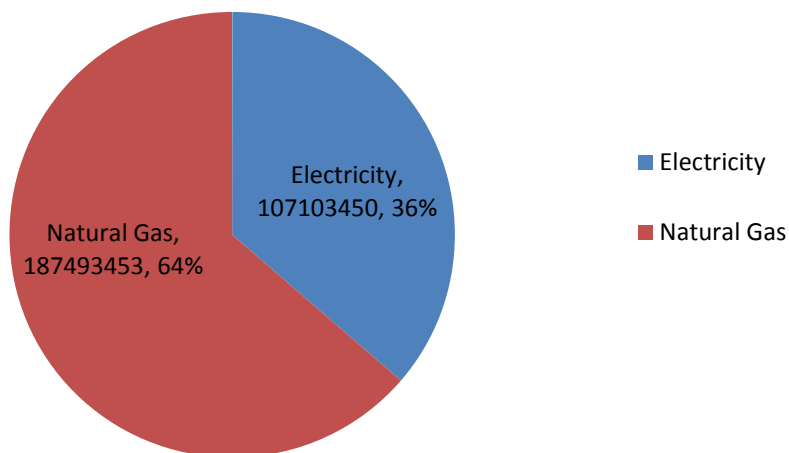
- Renzulli Gifted & Talented Academy has incomplete data for the 12-month selected timeframe. To complete the benchmarking, more energy bills are needed.

The following charts show the amount of money spent on each different type of energy used for Hartford Public Schools and total energy contributed by each energy source in kBtus in 2010. Whereas 73% of total energy cost is for electricity and 27% is for natural gas, natural gas contributes 64% of total energy used.

Total Cost per Energy Source Annually

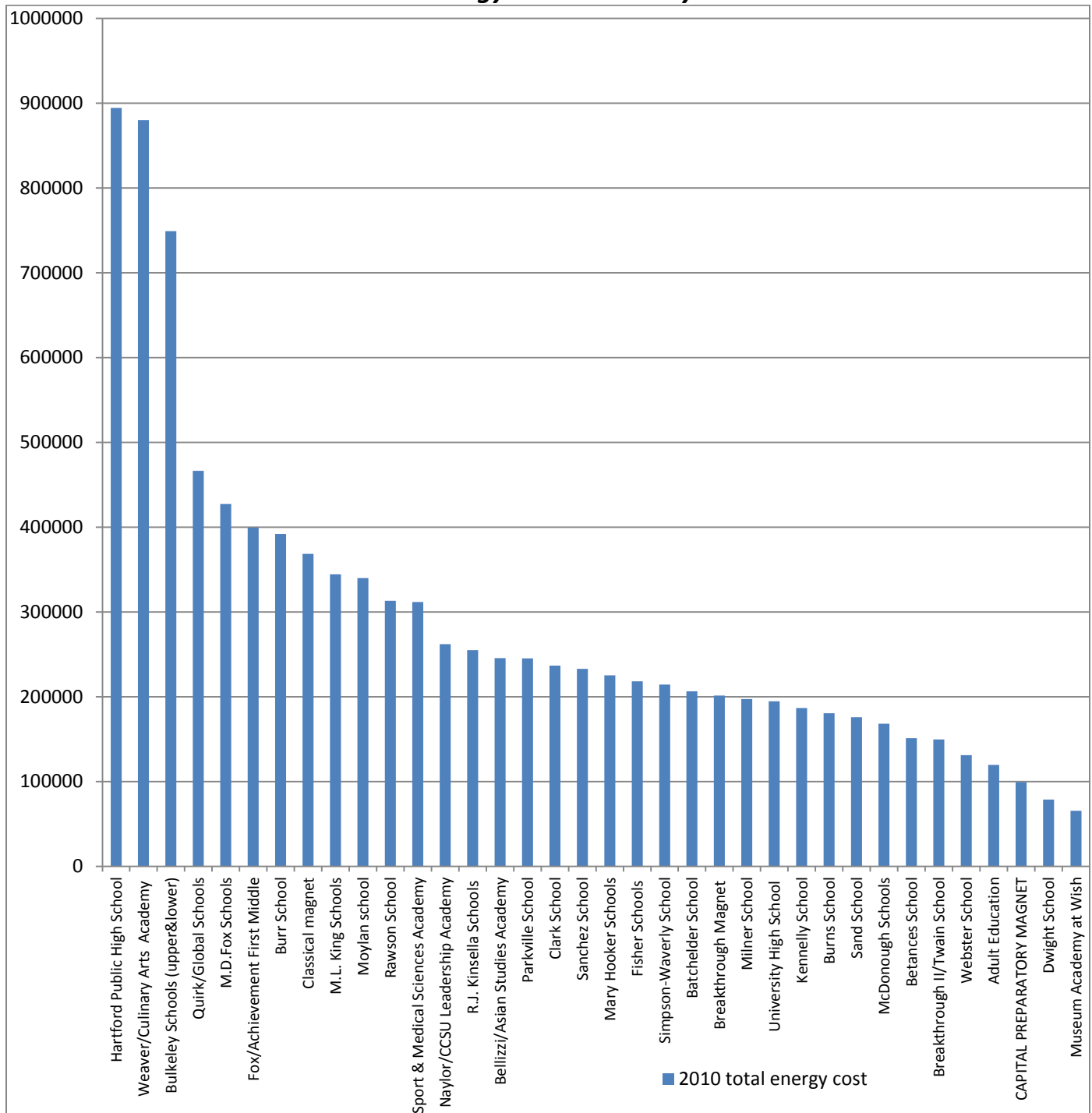


Total Energy in kBtus Annually



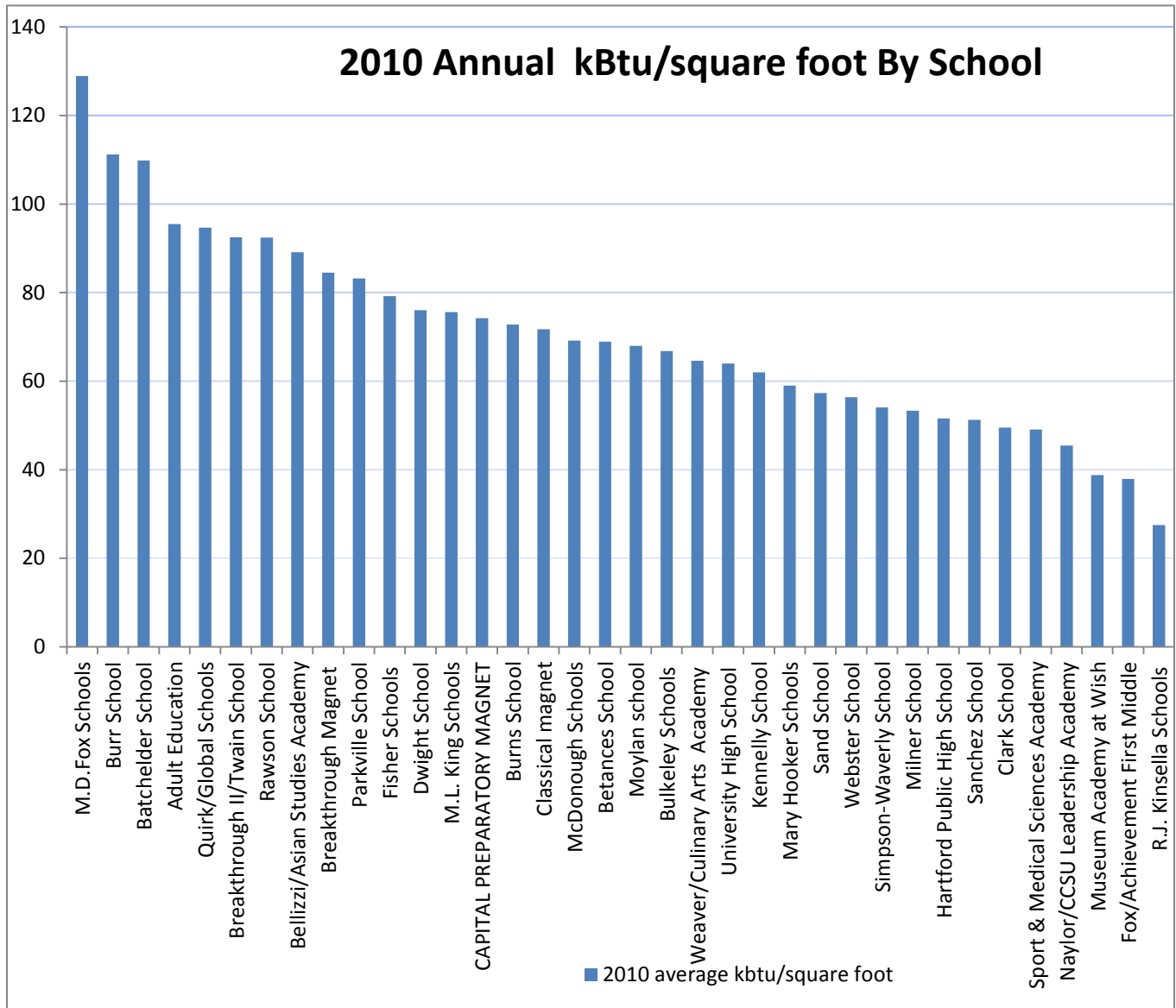
Cost Analysis

Total Energy Cost in 2010 By School



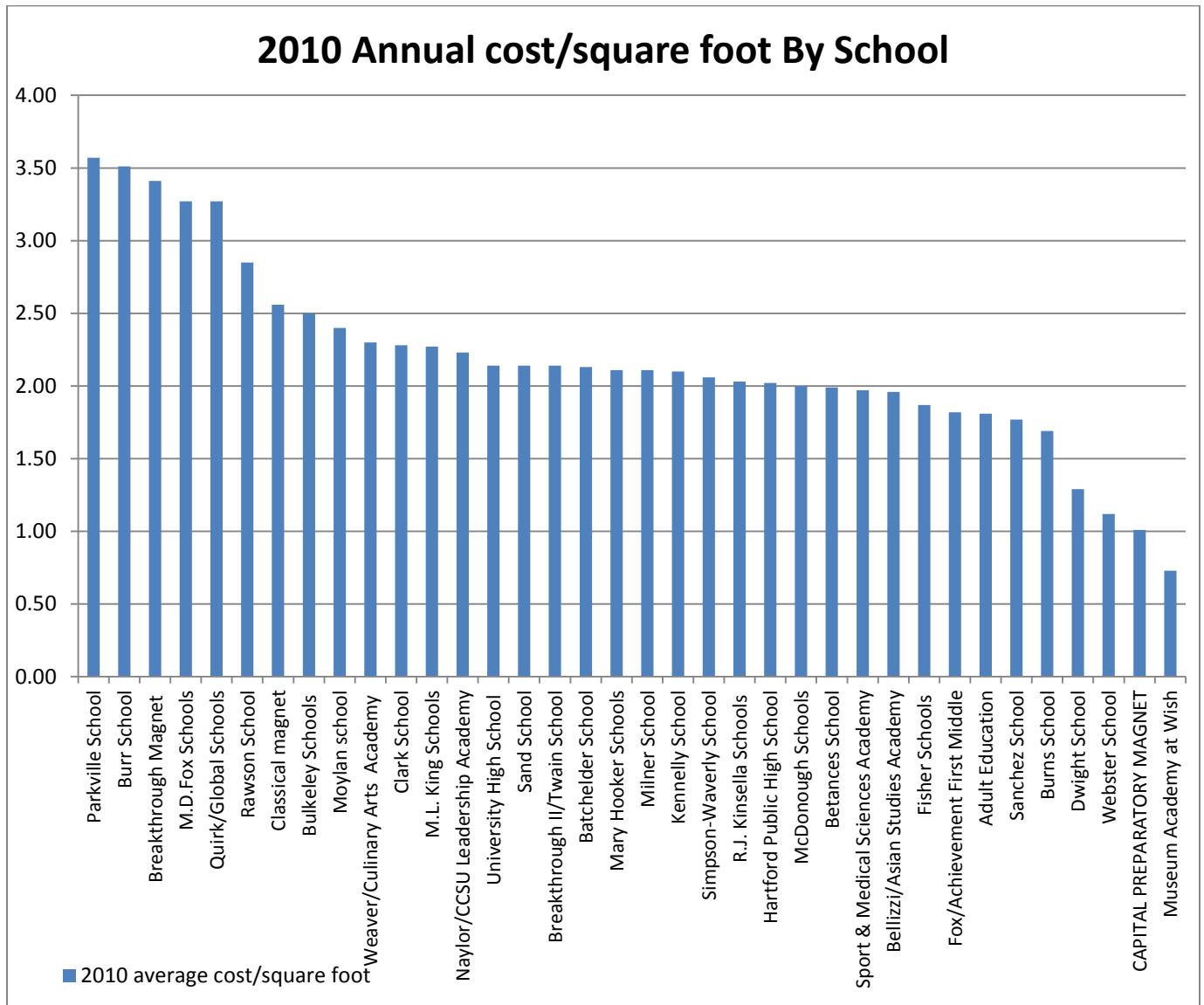
This graph compares the total annual energy costs of the Hartford Public Schools in fiscal year 2010. In this fiscal year, Hartford Public High School had the highest energy cost.

Analysis of Floor Space



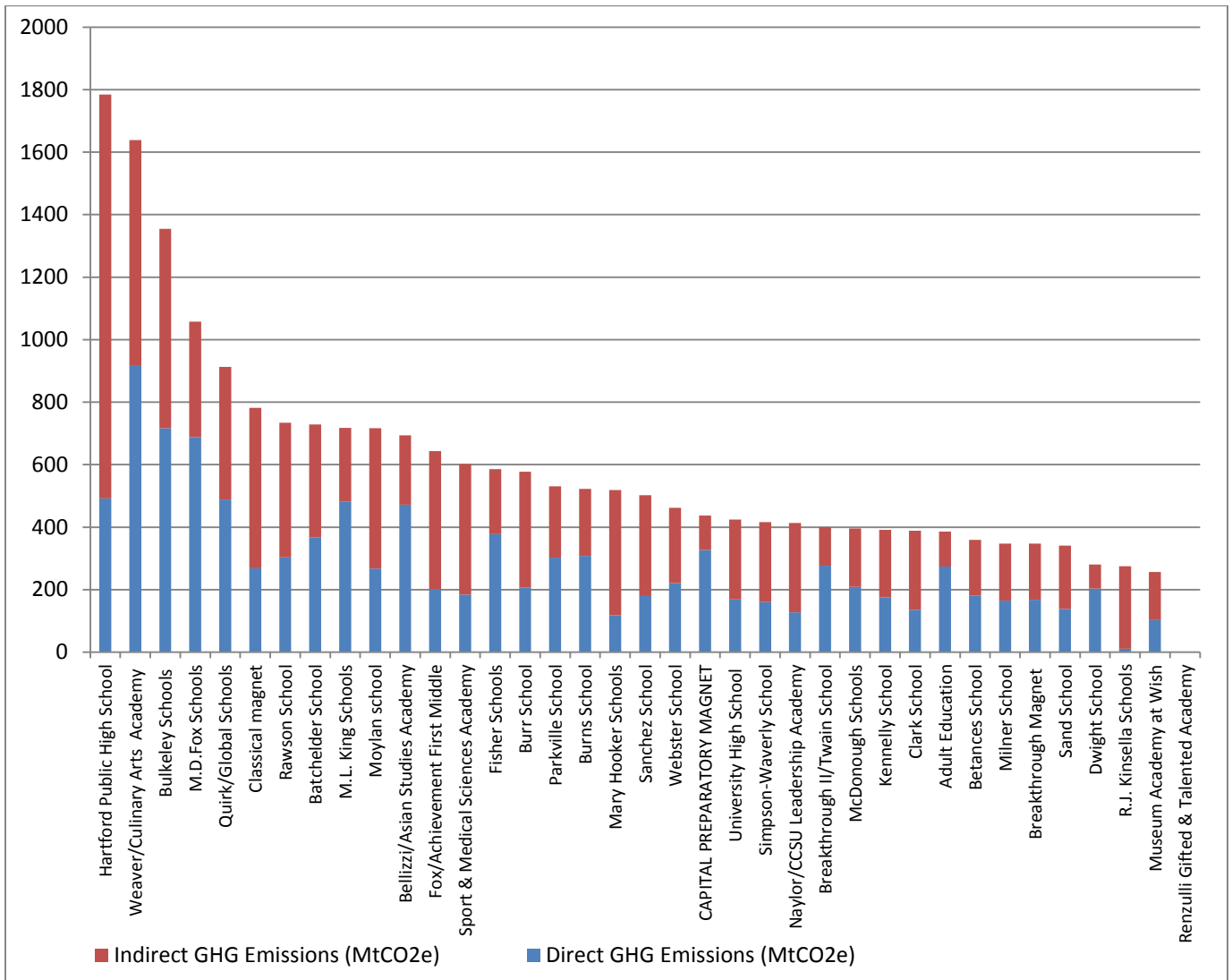
This graph shows the energy utilization of the Hartford Public Schools in energy units (kBtu) per square foot. Schools with the lowest energy use may serve as models for other schools within the district.

Average Cost / Square Foot (\$)



This graph shows the energy costs per square foot of the Hartford Public Schools in fiscal year 2010. The majority of the schools had a cost per square foot under \$2.50. Parkville School had the highest cost per square foot, \$3.57.

Greenhouse Gas Emissions Total Annual GHG By School



This graph shows the annual greenhouse gas emissions for all Hartford Public Schools in fiscal year 2010. Direct emissions are from the combustion of fossil fuels at the site and indirect emissions are created at the power plant from purchased electricity.

C. Recommendations

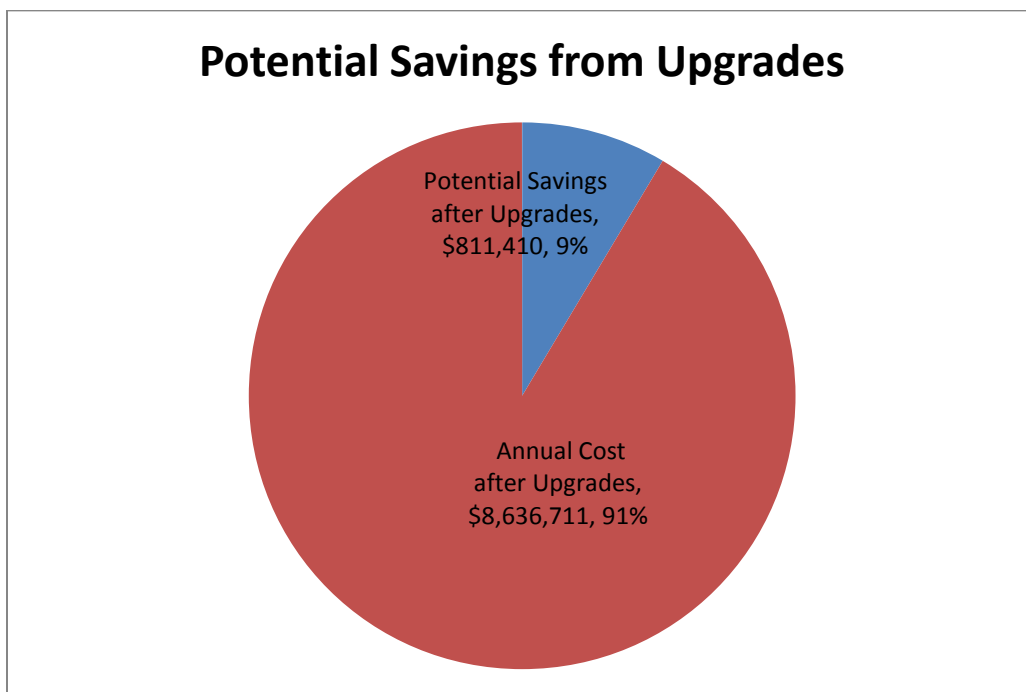
The results of the Hartford Public Schools benchmarking study are as follows:

- Six facilities received scores at or above 75, suggesting well-designed and well-maintained energy practices with efficient appliances and equipment. This is great!
- Thirteen facilities received scores above the national average of 50, suggesting well-designed and well-maintained energy practices and/or efficient appliances and equipment. However, these schools do not meet the standards for recognition by Energy Star K-12 Schools. This indicates the need for additional reduction of the school's energy consumption in order to achieve the Energy Star level.
- Seventeen schools scoring lower than 50 should have energy audits conducted by a certified energy auditor or engineer to determine opportunities for dramatically improving their efficiency, and consequently, their Energy Star score. If the steps outlined later in the report are followed with dedication and due diligence, additional Hartford Public Schools can increase their score above 75 and apply for Energy Star certification.

Potential Cost Reduction

The total amount of energy consumed annually by the Hartford Public Schools is 341,856,900 kBtus, at a cost of \$ 9,448,121 annually. By making improvements that would increase 29 of the schools to a score of at least 75, energy consumption would be reduced by 91,276,864 kBtu, and the total energy budget could be reduced by \$ 811,410 (9%) annually, as shown in the chart below.

Annual Cost with Maximum Efficiency



Typical Savings Opportunities

There are many opportunities to reduce energy consumption in school facilities. As detailed in Section II, assistance is available through [EnergizeCT programs](#), including Connecticut's Energy Savings Performance Contracting Program. Some of the most notable problems with school environments according to the Energy Star website are:

- Lighting
- Ventilation
- Indoor air quality
- Temperature control (heating and cooling)

These issues must be kept at the forefront of any plan for improving energy efficiency. Here is a list of the suggested improvements and the most common areas that may need attention in order to improve your school's scores according to Energy Star:

- Improved building shell
- Improved lighting
- Energy Star office equipment
- Reduced loads in unoccupied hours
- Air-side economizer
- Variable Air Volume (VAV) systems
- CO₂-controlled ventilation
- Reducing demand (kW) charges
- Energy recovery ventilation

Some general guidelines for reducing energy costs over time include:

- 1) Tune-up the HVAC systems in your school so that they are running as efficiently as possible. Frequently small improvements such as recalibrating thermostats can lead to savings.
- 2) Eliminate unnecessary power usage around your school, especially during unoccupied hours.
- 3) Improve the lighting by replacing any incandescent bulbs with CFLs or LEDs, and upgrade your fluorescent lighting systems to the latest technology.
- 4) Improve the building envelope, such as new roof insulation or windows replacements.
- 5) Upgrade HVAC systems. Once you maximize energy use and reduce energy load, your school's HVAC systems may be oversized. Consider retrofitting with smaller, more efficient systems using the savings accumulated from the first steps.

One way to learn about energy improvements for your school is to tour schools in your area that have already achieved an Energy Star label. A list of Energy Star schools can be found at http://www.EnergyStar.gov/index.cfm?fuseaction=labeled_buildings locator (select K – 12 schools as the facility type). There are 19 schools in Connecticut that have received the Energy Star Label, and with some work one of the Hartford schools could be next!

How to Apply for Energy Star Certification

Hartford schools that achieve a benchmarked score of 75 or above in Energy Star Portfolio Manager and that have at least one full year of energy data that is less than 120 days old can qualify for Energy Star certification. Applying for Energy Star certification is a streamlined and easy process in Portfolio Manager. There is no cost to apply for certification. Just log in to Portfolio Manager and follow the step-by-step instructions for your building that has a score of 75 or higher. The next step is to click on "apply for Energy Star certification" on the bottom right hand side of the profile for the qualifying school. You must then click on "Generate Application Documents." These include the Statement of Energy

Performance, the Data Checklist, and the Letter of Agreement. Carefully review these documents for errors to avoid any delay in your application process.

You must have a licensed Professional Engineer or Architect verify that all energy for that facility is accounted for and all of your building parameters are correct. This professional must then sign and stamp the Statement of Energy Performance and complete and sign the Data Checklist. The Professional Engineer or Architect must also verify that lighting levels and ventilation rates are appropriate for the space use and that the building does not have recurring problems with indoor air quality. The Letter of Agreement must be signed by the primary contact listed on the Statement of Energy Performance. Search directory [of licensed professional volunteers offering free ENERGY STAR verifications for K-12 schools and houses of worship](#). If using in-house staff to verify your application, refer to the [verify applications for ENERGY STAR certification](#) section to complete this process.

II. Implementing Energy Efficiency

The Institute recommends a comprehensive, integrated approach to addressing the energy and energy-related environmental issues being faced by communities today. There is no simple *single* solution. Connecticut has many programs and incentives, outlined below, to help Hartford pursue this comprehensive approach in implementing smart energy retrofits and practices and building greater awareness of energy efficiency, renewable energy, and sustainability.

A. Portfolio Manager

The Portfolio Manager accounts established by the Institute for Sustainable Energy for the Hartford Public Schools provide a very important energy management tool to track and assess energy and water consumption across your entire portfolio of buildings in a secure online environment. Portfolio Manager can help the City set investment priorities, identify under-performing buildings, verify efficiency improvements, and receive EPA recognition for superior energy performance.

Any building operator can efficiently track and manage resources through the use of Portfolio Manager. The tool allows you to streamline your portfolio's energy and water data, and track key consumption, performance, and cost information portfolio-wide. Benchmarking helps to:

- Prioritize investments in your building portfolio. Identify the top performers as well as the best candidates for upgrades.
- Target buildings that would benefit from engaging in energy and water efficiency programs.
- Determine potential savings. Compare a benchmarking score to a "target score" to show the energy savings potential of raising efficiency.
- Monitor changes over time. Evaluate the effectiveness of changes in equipment or management, through data on energy saved, dollars saved, and greenhouse gases avoided.
- Receive positive publicity. Documenting a building's improved energy efficiency or reduced energy consumption communicates an environmentally-friendly image.

It is important for Hartford to maintain these Portfolio Manager accounts with current energy data so the City can realize the many benefits of this energy benchmarking and tracking tool. The Institute for Sustainable Energy is an ENERGY STAR partner and was recognized as a National ENERGY STAR Partner of the Year in 2004 and 2014 for excellence in energy

education through its use of benchmarking with communities and the state. The Institute has benchmarked over 40% of Connecticut's public K – 12 schools and over 150 state facilities and is available to help Hartford maintain its Portfolio Manager accounts. Information on the [Institute's benchmarking help center](#) can be found under the "benchmarking" menu item on the Institute's website.

B. Building Operations and Maintenance Training

The Institute for Sustainable Energy, through funding from the Connecticut Department of Energy and Environmental Protection, runs a nationally accredited certification course that provides building managers with the critical tools to transition from conventional to sustainable operations and maintenance. *Green Professional Buildings Skills Operation and Maintenance Plus* (GPRO O&M Plus) is ideal for facility managers and building maintenance staff responsible for state and municipal buildings, including; commercial buildings; colleges and university facilities, and local schools. During the fall of 2014 and the spring of 2015, four different sessions of GPRO O&M Plus, including the manuals and certification exam, will be offered at no cost to state and municipal employees. Hartford's building and maintenance staff members should sign up for this free course. For more information and to sign up for GPRO, contact ISE@easternct.edu.

Who should attend?

- Facility and property managers
- Building superintendents
- Building system operators
- Building maintenance personnel

C. Energize Connecticut Programs

Energize Connecticut provides Connecticut residents, businesses, and communities with resources and information to save money and energy. The Connecticut Energy Efficiency Fund is designed to make it easier for residents, businesses and communities to obtain technical assistance and incentives to use more energy-efficient equipment – to save money, energy and the environment. These programs will provide energy audits to identify energy savings opportunities in schools with low benchmarking scores and incentives to implement energy upgrades. The Institute for Sustainable Energy and/or Hartford's CL&P account representative can help the City connect with EnergizeCT programs and incentives to reduce energy use in Hartford Public Schools. Visit <http://www.energizect.com/government-municipalities/> for more information.

D. Lead by Example and Energy-Savings Performance Contracting

"Lead by Example" is a program run by CT's Department of Energy & Environmental Protection designed to promote energy efficiency in state and municipal buildings. The program was created to reduce the energy use in state buildings by 10% by 2013, and another 10% by 2018, consistent with goals set by the legislature, and to help make Connecticut the most energy-efficient state in the nation.

As part of Lead by Example, DEEP developed a Standardized Energy-Savings Performance Contracting Process (ESPC) for use by state agencies and municipalities. ESPC enables agencies and towns to implement multi-million dollar energy retrofits spanning multiple buildings, paid for through vendor-guaranteed future energy savings. The program includes a broad range of resources to support ESPC projects, including: a pre-qualified list of energy services providers that will identify, install, and guarantee the energy savings measures; a complete set of ESPC contract documents that have been approved by the Office of the Attorney General; energy engineering technical assistance to review proposed energy

measures and documented energy savings; and technical support on financing ESPC projects through the Clean Energy Finance and Investment Authority (CEFIA).

For more information go to: www.ct.gov/deep/leadbyexample

To initiate a project under the state ESPC program, contact: ESPC@energizect.com

E. Connecticut Clean Energy Communities

The City of Hartford is one of over 100 Connecticut municipalities that have joined the [Connecticut Clean Energy Communities Program](#). The program, jointly supported by the Clean Energy Finance and Investment Authority and the Connecticut Energy Efficiency Fund, helps community leaders, resident, and local businesses set energy efficiency and clean energy goals and be rewarded for their achievements. The City should continue to take advantage of the many resources available through this program.

F. Connecticut Green LEAF Schools

The Institute for Sustainable Energy helps to lead the Connecticut Green LEAF Schools program, which can enhance the sustainability initiatives of the Hartford Public Schools. Some Hartford schools --Environmental Sciences Magnet School at Mary Hooker, Two Rivers Magnet High School, and Annie Fisher STEM Magnet School -- are already participating in The Green LEAF Schools Program. Participating schools are supported in working toward three goals: educating students about sustainability and environmental literacy; promoting health and wellness for all students and staff; and reducing the cost and environmental impact of resources used in the school. All K-12 schools are eligible to participate. Schools sign on with a Principal's Letter of Commitment and then complete a school Self-Assessment, and set their own action plan. The program provides assistance in greening the school through workshops and connections to statewide programs. As schools become greener, they may be eligible for state and national recognition. Information is available at www.ctgreenleaf.org. The program has been recognized for exemplary work by the US Department of Education, the Center for Green Schools, and the Connecticut Green Building Council.