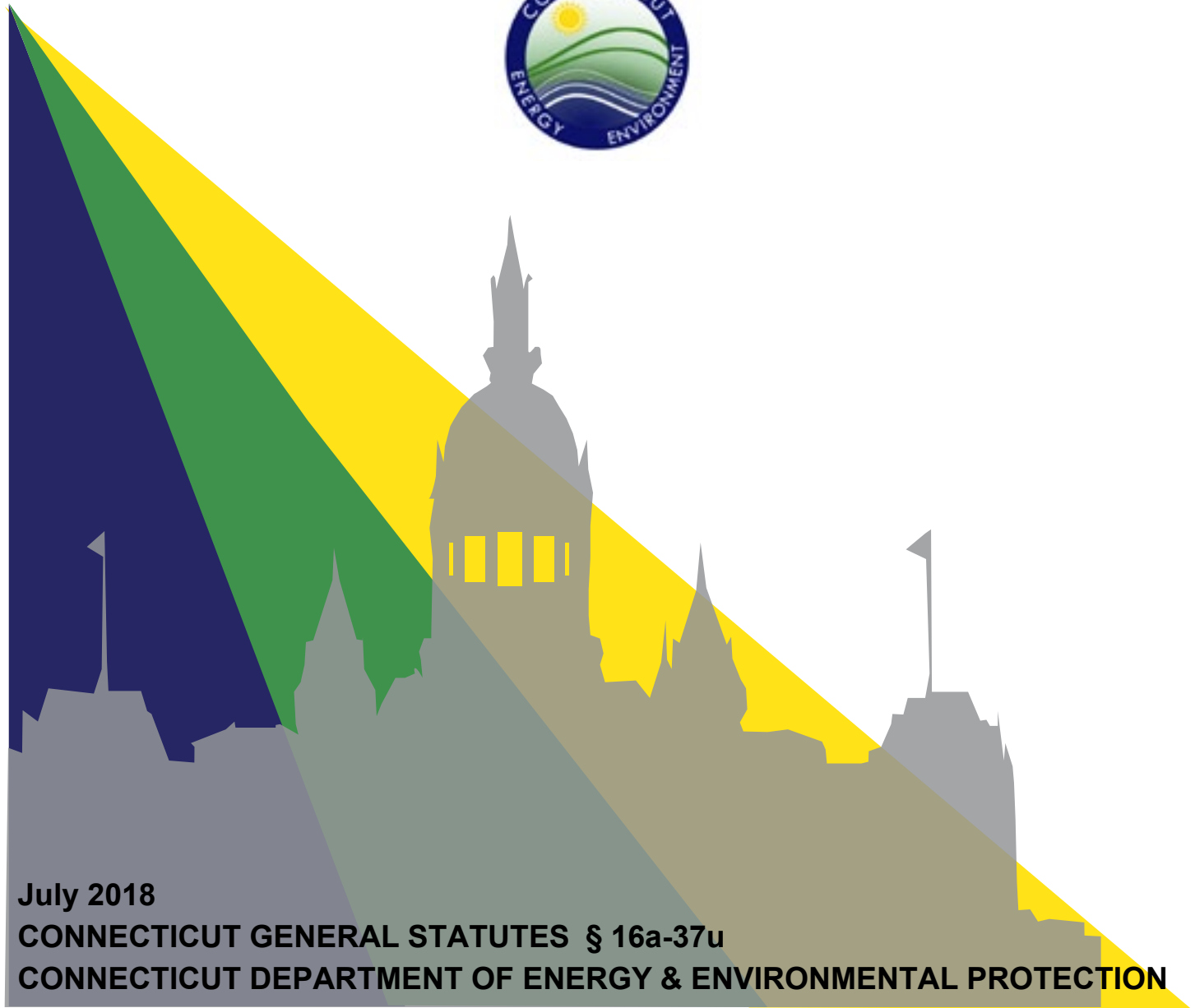


Leading by Example:

REDUCING ENERGY USE IN STATE FACILITIES

2017



July 2018

CONNECTICUT GENERAL STATUTES § 16a-37u

CONNECTICUT DEPARTMENT OF ENERGY & ENVIRONMENTAL PROTECTION

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Executive Summary 2017

Overview

The Department of Energy and Environmental Protection (DEEP), in consultation with the Department of Administrative Services and others, carries out statutory responsibilities to maximize energy efficiency in state government buildings and strategically improve the management of energy use in state facilities. Various public acts through the years have identified such responsibilities, and in 2011 the legislature formalized the state's initiatives through the development of a "[Lead by Example](#)" (LBE) approach pursuant to Public Act 11-80. Through this approach DEEP assists Connecticut state agencies in reducing energy use in state buildings, in accordance with the objectives established in Connecticut General Statutes Section 16a-37u, and in improving energy management in state buildings, consistent with DEEP's various statutory obligations.¹

Progress and Constraints

A variety of actions advanced energy savings and continued to reduce operating costs at Connecticut's state facilities in 2017, as well as laid the foundation for future savings and cost reductions. Multiple facilities completed energy upgrades funded through utility-administered energy efficiency investments and from allocations of state bond funding received prior to 2017.

One example of a significant constraint to progress is the lack of available capital for investing in energy efficiency upgrades. Specifically for 2017, previous capital bond allocations were fully expended at the end of calendar year 2016 and there was no new legislative appropriation for funding in calendar year 2017, resulting in curtailed activities that require capital investments at state facilities, until passage of the state's budget October 31, 2017². The budget included funding authorization of \$20 million for each of State Fiscal Years 18 and 19 (SFY 18 and SFY 19). This authorization will likely primarily be allocated for a single large-scale project, with \$2 million allocated for mid-sized projects in SFY18 and an undetermined allocation for SFY19.

Limited capital availability through the utility-administered Electric and Natural Gas Conservation and Load Management Plan [Electric and Natural Gas Conservation and Load Management Plan](#) investments have also resulted in rationing of efficiency and demand management projects for the government sector that would otherwise have spurred reductions in state facilities' operating costs. This condition worsened in 2017 with the passage of the state's budget. Small efficiency upgrade projects that don't require upfront capital were curtailed throughout all utility customer sectors due to the October 31, 2017 legislative diversion to the state's General Fund of utility collections originating from a charge on electric consumption.³ A total of \$127 million

¹ DEEP submits this report pursuant to Connecticut General Statutes (C.G.S.) Section 16a-37u(d), which requires that DEEP annually report "on the status of its implementation of the plan [required by C.G.S. §16a-37u(a) and (b)] and provide recommendations regarding energy use in state buildings to the joint standing committee of the General Assembly having cognizance of matters relating to energy."

While DEEP routinely updates information on DEEP's webpages, this report specifically meets the reporting requirement for 2017. Reports for 2012 through 2016 have previously been submitted and can be found on the [Lead by Example](#) page on DEEP's website.

² [June Special Session Public Act 17-2](#), *An Act Concerning the State Budget for the Biennium Ending June 30, 2019, Making Appropriations Therefor, Authorizing and Adjusting Bonds of the State and Implementing Provisions of the Budget* ("June SS P.A. 17-2")

³ On October 31, 2017, [June Special Session Public Act 17-2](#), *An Act Concerning the State Budget for the Biennium Ending June 30, 2019, Making Appropriations Therefor, Authorizing and Adjusting Bonds of the State and Implementing Provisions of the Budget* ("June SS P.A. 17-2"), became law, effective on passage. The public act identified the diversion of funds to cover the state budget deficit. These diversions included redirection of \$63.5 million each fiscal year from the conservation mill charge on electric ratepayers' bills and a portion of Connecticut's revenue from RGGI auctions, reducing by \$68 million per year the funds available to implement the Plan in calendar years 2018 and 2019.

that had been approved for implementation of Connecticut’s Conservation and Load Management Plan at businesses, government facilities, and residences prior to the passage of the budget for SFY 18 and SFY 19 was diverted, resulting in holds on contracts and projects across all utility customers, including state facilities.

Opportunity

These recent disinvestments in energy efficiency increase the opportunity cost of not reducing energy use in state facilities. Connecticut’s state facilities spend approximately \$80 million per year in energy costs. Typically, energy costs can be reduced from 20% - 30% in many buildings when wasteful processes and building upgrades are completed that make buildings more energy efficient. This represents significant opportunity for operational savings for the state. Government sector buildings account for approximately 15% of electricity and natural gas consumption by commercial and industrial energy consumers throughout Connecticut, which means that reducing energy waste at state facilities has a measurable effect on the overall energy demand for which capacity planning must account. LBE program components, including data-driven decision making, benchmarking of buildings, and collaboration across state agencies, have led to important energy efficiency upgrades and other clean energy installations that will help to save the state money, keep a check on energy demand, and reduce harmful environmental impacts.

However, to capture the savings from reducing energy waste in state buildings, a sustainable and predictable funding source needs to be put in place. A sustainable funding source is needed both for investing in the state building infrastructure and in ensuring the implementation of the Conservation and Load Management Plan, which guides the investments in energy efficiency and demand reduction statewide.

Path forward

The Department of Energy and Environmental Protection (DEEP), in consultation with the Department of Administrative Services (DAS) and the Office of Policy and Management, implements the state’s plan for the reduction of energy consumption in state buildings, as required by C.G.S. §16a-37u, §16a-38a, §16a-38i, and §16a-38l. Implementation relies on the cooperation of all state agencies, and is required by C.G.S. §16a-6.

This report identifies a variety of pathways that state agencies are following in their efforts to maximize energy efficiency in their facilities. The coordinated and accelerated path that DEEP offers through the Lead by Example approach includes utility administered energy efficiency investments, bond-funded capital investments, and ongoing work to integrate energy management overall with specific efficiency investments and renewable energy generation investments. The progress to date is detailed on the following pages.

2017 Snapshot of Accomplishments in State Facilities' Energy Management

- ✓ Completed a competitive aggregated electricity supply purchase, in partnership with DAS, to procure a competitive rate for electricity supply for state facilities, saving state approximately \$1 million per year in operating costs.
- ✓ Leveraged utility incentive programs for small-scale projects for use by state agencies, achieving more than \$1 million in **annual** savings from over 140 projects completed or underway since 2014.
- ✓ Continued realizing annual savings from upgrades completed from bond-funded projects that were funded before the bond funding was depleted at the end of 2016.
- ✓ Negotiated and executed Connecticut's first Energy Saving Performance Contract (ESPC), at CT Valley Hospital for DMHAS
- ✓ Established a web-based platform, EnergyCAP, for compiling and tracking state energy data, and all state energy accounts have been integrated into the system.
- ✓ Conducted training for all state agencies to use EnergyCAP, enabling building managers to see their consumption.
- ✓ Received Eversource electricity and natural gas consumption data through Electronic Data Transfer going back to Fiscal Year 2016.
- ✓ Initiated Electronic Data Transfer for United Illuminating data to flow into EnergyCAP, building on the successful data flow already underway for Eversource data.
- ✓ Convened inter-agency task force to prioritize state buildings energy management upgrades in anticipation of future funding via utility investments or bond funding.
- ✓ Continued the development of contracts for state agencies to install renewable energy.
- ✓ Installed renewable energy on Connecticut State Colleges and Universities' campuses.

Plan for Improving Energy Management at State Facilities

Overview

Connecticut General Statutes Sections 16a-37u and 16a-38/ authorize and charge DEEP with the responsibility of planning, managing, and reducing energy consumption in state-owned and leased buildings. As we more fully consolidate data and analyze how much energy the state uses and pays for, we can develop a more accurate and reliable baseline, prioritize what buildings consume the most energy, and implement upgrades, when funding is available, to ensure these buildings perform more efficiently. DEEP continues to refine a statewide baseline for energy consumption for all state agencies⁴. Based on the information currently available, the figure below provides an estimate of statewide energy consumption and costs (approximately \$80 million)⁵ for State Fiscal Year 2017.⁶

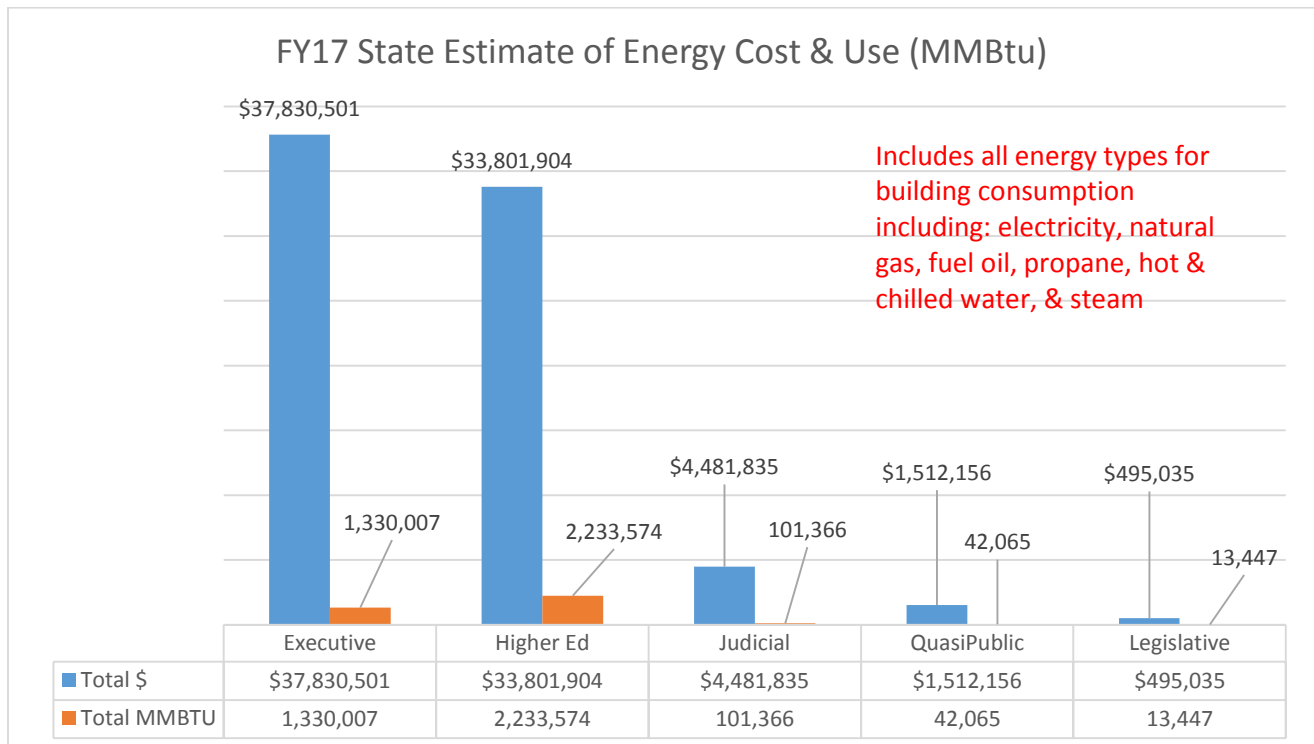


Figure 1: Snapshot of State Fiscal Year 17 Estimated Energy Cost and Use

DEEP continues to conduct inter-agency coordination meetings with DAS and OPM to update the State Facilities Energy Management Plan. Along with coordinating with DAS and OPM, DEEP continues to meet with state agencies on their energy management needs for their facilities. In order to determine what upgrades need to be done, DEEP has asked the state agencies to ensure they complete an account to building correlation. This is the first step in addressing how much energy is being consumed by individual buildings. Completing this task does

⁴ With the development and implementation of EnergyCap, DEEP expects to continue to update and refine this baseline over time as state agencies enter additional data including historical data enabling DEEP to conduct more robust data analysis

⁵ \$80 million for 2017 is based on a variety of information sources, include DEEP’s compilations of energy accounts and Office of the State Comptroller records.

⁶ This chart reflects a percentage of the total until all UI, CNG, and SCG information is received electronically and deliverable fuels are completely identified.

not prevent other actions from being taken to improve energy management at state facilities, as planning and implementation occurs concurrently. Figure 2 shows how the process begins in reducing energy and cost, and is described in more detail in the following section.

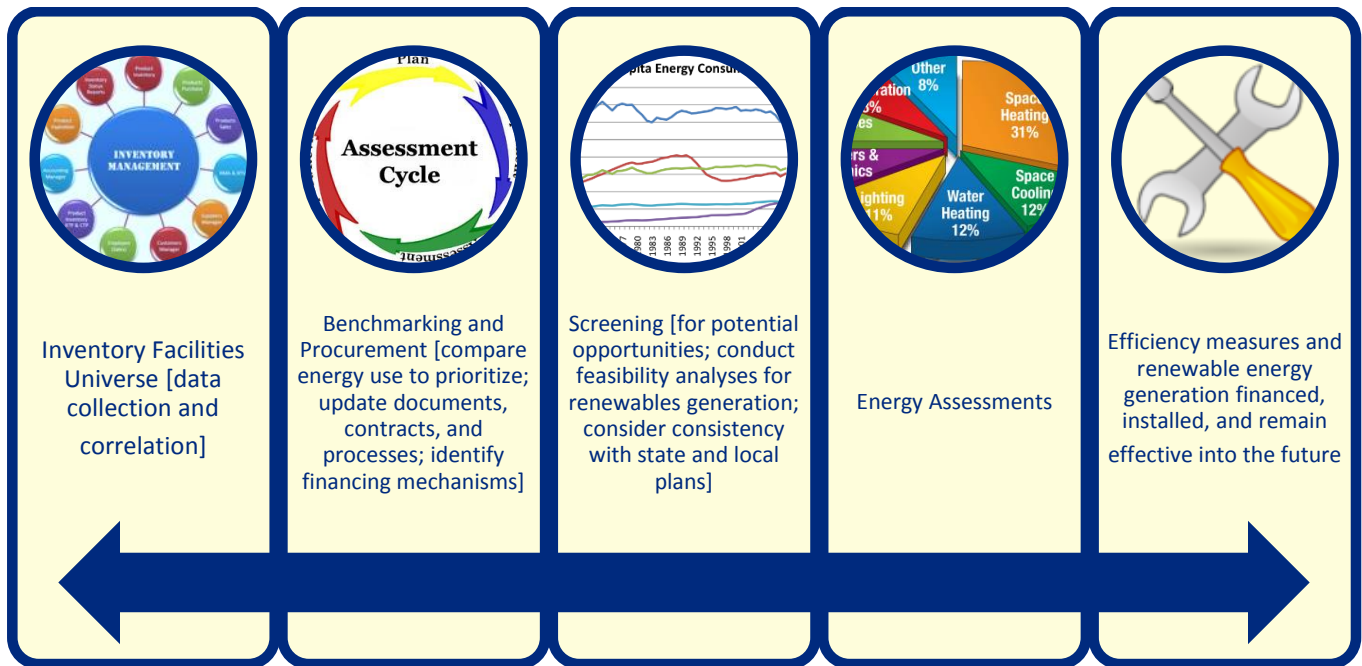


Figure 2: Implementation of State Facilities Energy Use Reduction

Inventory of State Buildings and Energy Accounts

Connecticut has a dynamic inventory of state buildings that continues to change each year. In order to reduce our energy use, a comprehensive inventory of state buildings and energy accounts is essential. Each state agency annually compares their list of their owned and leased buildings with the Office of Policy and Management (OPM) state buildings inventory database. OPM’s data base, known as JESTIR (Joint Effort State Inventory Resource), allows agencies to see which buildings still exist, what new buildings there are, what buildings no longer exist, and what is no longer state property. Every state agency has a point person to update their agency’s building inventory list to submit to OPM.

All state energy accounts for all utilities for all state agencies need to be identified concurrently with updating the building inventory. This is to correlate accounts and meters to the correct building to identify the energy consumption and cost for a specific state building. Accounts and buildings do not always have a one-to-one relationship, as sometimes a single meter feeds multiple buildings. Some agencies have power plants that produce energy that gets distributed to several buildings. For example, natural gas and water can be used to run boilers that produce steam to help heat buildings. DEEP works with each state agency to identify all state energy accounts, the energy commodities consumed, the associated energy costs, as well as matching state-owned buildings to accounts and meters. This is a continuous task as new accounts become active and inactive. Figure 3 shows a snapshot of known accounts the state has per commodity.⁷ DEEP has adopted EnergyCAP, a commercially available web-based program accessible to states via the federal General Services Administration, to track energy use by building, described in more detail in the next section. As information is uploaded into

⁷ The number of accounts continuously changes, as accounts become active and inactive throughout the year.

EnergyCAP, we are discovering accounts that were not identified as state accounts in previous efforts to estimate statewide energy consumption.

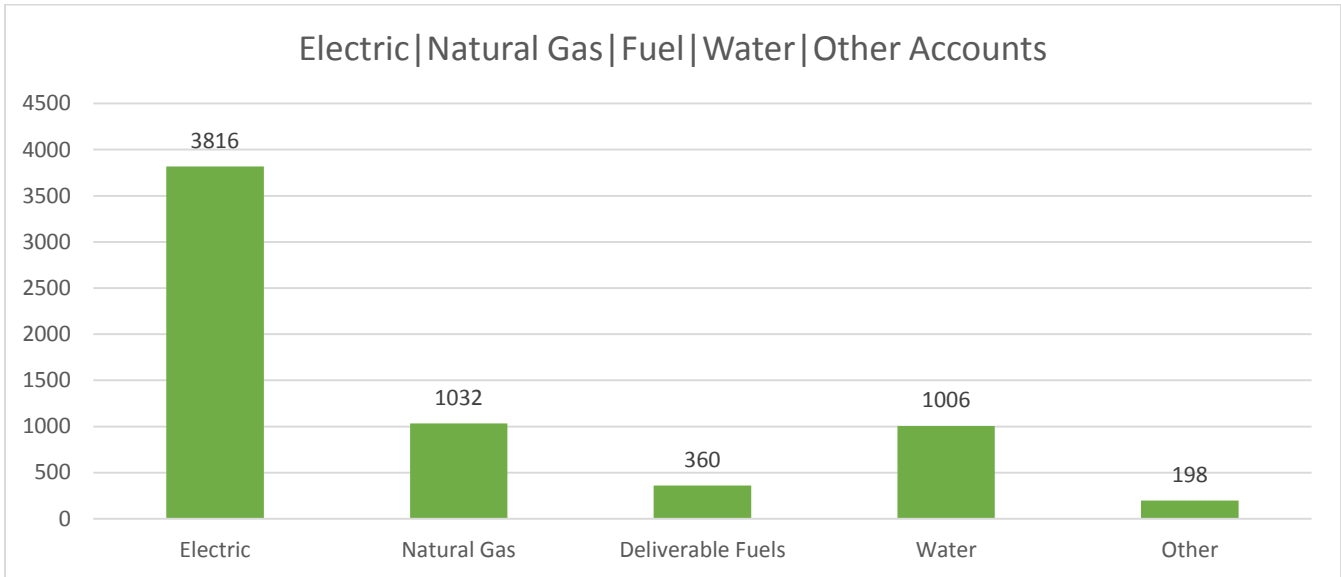


Figure 3: Current number of state accounts identified [data compilation is ongoing]

Energy Data Management Platform

In 2016 DEEP procured the web-based EnergyCAP system, through the federal General Services Administration. This system allows DEEP to track energy cost and consumption down to the building level for all state agencies. In 2017 we were able to complete the identification of all state agency energy accounts for electricity and natural gas, as well as a significant portion of the accounts for deliverable fuels [heating oil, propane].

EnergyCAP Overview

EnergyCAP is a utility bill and energy management analysis platform that allows clients to track energy and greenhouse gas data, target goals for reducing energy consumption, benchmark buildings and submit to E.P.A. Energy Star Portfolio Manager, measure energy savings, process and audit utility bills, and much more. In addition to the numerous capabilities the system has, the company provides implementation, training, bill processing, and support services.

Connecticut's EnergyCAP Profile

For almost two years, Connecticut has been implementing EnergyCAP to track our state's energy use and cost through an on-line platform accessible to all state facility managers and business office personnel. EnergyCAP has been populated with state building and utility account information. Our state's building profile in EnergyCAP is set up as a tree structure, broken out by Executive Branch, Higher Education, Judicial, Legislative, Metro North Railroad, and quasi-public agencies. Within those organizations, it's segmented further either by campus, facility, or building, as shown in figure 4. There is similar tree structure for our utility accounts, broken out by the different branches of government. In 2017 DEEP populated EnergyCap with data on all known state owned and leased buildings, as well as all known state energy accounts and matched utility meters to buildings. Not all energy account and buildings have a one-to-one relationship, which means that one account may be used for multiple buildings or agencies, and multiple accounts may be used at a single building. If a utility meter feeds multiple buildings, that meter is split, by square foot, to get a closer understanding of the energy use in a building.

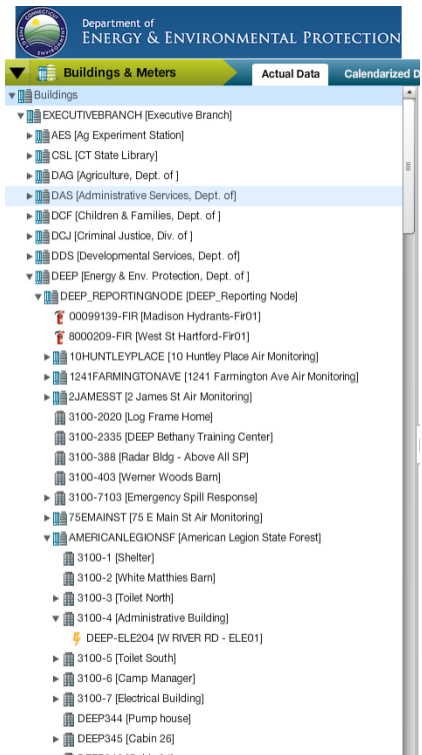


Figure 4: EnergyCAP Tree Structure

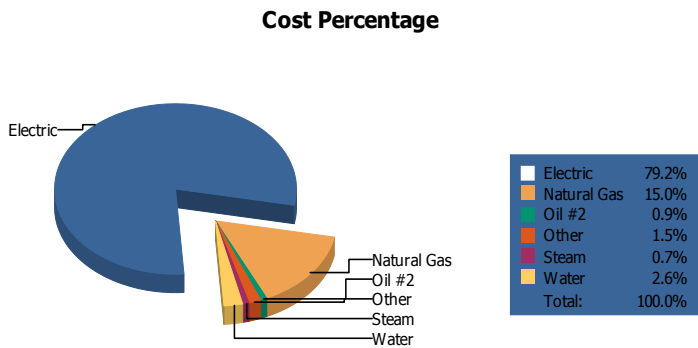


Figure 5: State Energy Cost Percentage [data compilation is ongoing]

DEEP has been continuously working with Eversource and United Illuminating LLC (UIL) to transition to a paperless process to upload utility information into EnergyCAP, and eliminating manual uploads of thousands of paper invoices received monthly. Eversource implemented and electronic flow for both electricity and natural gas data into EnergyCAP, including historical data back to Fiscal Year 16. UIL is developing their electronic data interface (EDI) so that both UI electric, Connecticut Natural Gas, and Southern Connecticut Gas can automatically flow data into EnergyCAP by the end of 2018. Deliverable fuels

(all oil types, propane, and gasoline), water, sewer, and other energy accounts will continuously need to be manually scanned and uploaded to EnergyCAP by the agencies, unless vendors are capable of providing such data electronically. DEEP will monitor this capability in future years. With the utility information flowing electronically, trained state agency employees can examine what their energy cost and consumption looks like, and determine which of their buildings use large amounts of energy. Figures 5 and 6 are a snapshot of the

energy use and cost percentage in EnergyCAP.⁸ As additional fuel oil and propane accounts are identified and added to EnergyCAP, these percentages will be updated.

EnergyCAP is available for state agencies to manage their energy consumption data. EnergyCAP hosted training at DEEP’s facilities in New Britain and Hartford, in October of 2017, for facility managers and business office employees to learn how to use the system. This will also help bridge the gap between facility consumption and overall energy costs. EnergyCAP will allow both financial and facilities managers to review energy information. EnergyCap includes functionality to enable fiscal staff to run billing and budget reports, and audit their utility bills.

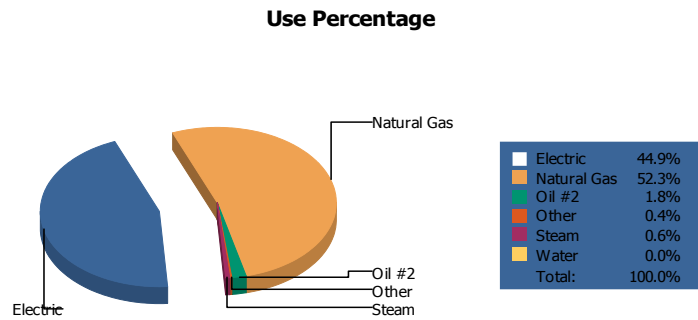


Figure 6: State Energy Use Percentage [data compilation is ongoing]

Prioritizing & Benchmarking

DEEP uses EnergyCAP to screen, assess, and prioritize potential energy projects for state buildings for energy upgrades. In consultation with key agencies, DEEP recommends which state buildings represent the greatest opportunity for potential retrofit upgrades and assess the feasibility for installing renewable energy generation sources. In 2017, DEEP and other key agencies continued to confer with agencies whose capital or operating plans call for investment in energy management and therefore prompt those agencies to pursue energy management improvements. Concurrently, Eversource and UIL provide insight on the energy efficiency investments they offer and provide energy assessments and technical assistance to agencies. While DEEP is working on prioritizing buildings, DEEP also screens buildings that have already been benchmarked that have poor rating scores in Portfolio Manager. Table 1 shows a snapshot of the top 25 high energy cost buildings, based on currently available data.⁹

⁸ Snap shot of current data in EnergyCAP. Data not complete.

⁹ The table represents a snapshot of the information we have currently compiled in EnergyCAP. The data has not been fully correlated to match buildings to accounts. This chart will change.

Top 25 Buildings by Estimated Annualized Cost (less Higher Education)						
Building Name	Location	ID	Agency		Sq. Ft.	Est. Annualized Cost
CT National Guard Hangar	Groton	2201-46	MIL	Owned	126,841	\$3,231,078.89
MacDougall Correctional Institution	Suffield	8000-161	DOC	Owned	480,680	\$1,565,736.96
State Armory Westbrook	Westbrook	2201-73	MIL	Owned	13,929	\$1,557,647.01
State Armory Vernon/Rockville	Vernon-Rockville	2201-71	MIL	Owned	13,999	\$1,094,918.80
OPM Office	Hartford	1326-486	DAS	Owned	31,735	\$1,026,704.86
Connecticut River Plaza	Hartford	1326-8240	DAS	Owned	914,457	\$941,034.48
CT National Guard Barracks	Camp Nianic E Lyme	2201-206	MIL	Owned	19,191	\$916,104.98
Office Building 505 Hudson St	Hartford	1326-481	DAS	Owned	155,264	\$910,134.92
GA20 Courthouse Norwalk	Norwalk	9001-20	JUD	Owned	33,000	\$865,377.58
CT National Guard Barracks	Camp Nianic E Lyme	2201-205	MIL	Owned	19,191	\$856,293.65
Dept of Insurance	960 Main, Hartford	064-12	DAS	Leased	41,887	\$800,084.02
DOT Administration Building - HQ	Newington	5000-4252	DOT	Owned	363,719	\$700,455.56
Office Building 55 Farmington	Hartford	1326-8239	DAS	Owned	384,808	\$590,945.95
DEEP HQ Building	Hartford	1326-32	DAS	Owned	280,300	\$582,914.23
Southeastern Mental Health Center	Uncas On Thames, Norwich	1303-530	DAS	Owned	55,264	\$541,323.76
Norwich DMV Branch	Norwich	2101-9	DMV	Owned	5,014	\$535,117.08
Office Building 25 Sigourney St	Hartford	1326-480	DAS	Owned	467,000	\$516,258.89
Rowland State Government Center	55 W Main, Waterbury	1326-7101	DAS	Owned	99,691	\$424,581.50
Platt Regional Vocational Technical School	Platt RVTS, Milford	7001-16	SDE	Owned	221,320	\$420,069.50
Eli Whitney Regional Vocational Technical School	Whitney THS Hamden	7001-8	SDE	Owned	178,763	\$418,545.36
State Capitol Building	Hartford	1001-14	OLM	Owned	181,000	\$415,499.63
Norwich Regional Vocational Technical School	Norwich RVTS	7001-14	SDE	Owned	99,626	\$403,698.37
DVA Power Plant	Rocky Hill	1312-6	DVA	Owned	29,115	\$401,584.69
DOC HQ - 24 Wolcott Hill Rd	Wethersfield	1326-6	DAS	Owned	115,000	\$377,212.45
Office Building 61 Woodland Street	Hartford	1326-8532	DAS	Owned	213,421	\$372,935.27

Table 1: Example of Buildings with High Energy Cost [data compilation is ongoing]

Connecticut General Statutes Section 16a-37t states that DEEP may benchmark energy and water consumption of all residential and nonresidential buildings owned or operated by the state with a gross floor area of ten thousand square feet or more using the United State Environmental Protection Agency’s Energy Star Portfolio Manager (Portfolio Manager) tool¹⁰. Portfolio Manager is a nationally used free tool to compare buildings of similar characteristics across the country that are benchmarked, and assigns an individual building an Energy Use Index score or Energy Star rate score. DEEP has benchmarked buildings into Portfolio Manager for several state agencies, as part of the requirement in a Memorandum of Agreement in participating in the Lead by Example Bond Funded Program. In 2017, DEEP worked with Eversource and UIL to implement and electronic data flow into EPA’s Portfolio Manager Tool for buildings that have one to one building to account correlation. Each agency has the option to allow the Utility Companies to have full access to their Portfolio Manager profile to upload their utility information. To “Lead by Example,” DEEP has benchmarked all DEEP buildings over 4,000 square feet into Portfolio Manager. As a whole, the state has almost 300 state buildings and facilities benchmarked, which is approximately 27 million square feet of state property. In order to be able to get all our buildings to be benchmarked, the account to building correlation needs to be completed first. DEEP is working with individual agencies to get the data correlated.

Lead by Example

Overview of Lead by Example

Since 2013, the “Lead By Example” (LBE) program has provided assistance to state agencies to do energy retrofits and upgrades to their facilities and buildings. LBE has helped many state agencies that lack the

¹⁰ US EPA created the Energy Star Portfolio Manager as an on-line tool to track energy and water consumption in buildings, as well as greenhouse gas emissions, and can be used to benchmark the performance of a single building or a portfolio of buildings.

technical and financial resources to identify and implement sustainable investments in efficiency upgrades. The inter-agency team of DEEP, the Department of Administrative Services, the Attorney General's Office, the Office of the Treasurer, the Office of Policy and Management, the CT Green Bank, and others, have advanced the program to include the following initiatives and financing mechanisms to reduce energy use in state buildings:

1. Established master agreements with Connecticut's utilities to unlock the ability of state agencies to use utility administered programs to complete small-scale energy efficiency investments in facilities;
2. Continued to install medium-scale energy equipment retrofits in state facilities using up general obligation bond funded allocations from previous years, as no new allocations were received in 2017;
3. Initiated a standardized guaranteed Energy Savings Performance Contracting Program to plan for and implement large-scale, comprehensive projects with multiple energy savings measures at state facilities.

For more information: please refer to the [Lead by Example](#) state agencies page on DEEP's website.

Small-Scale Projects

The utility-administered program designed to provide cost effective, turnkey energy-saving services to smaller utility customer accounts is known as the Small Business Energy Advantage program (SBEA). The program offers utility administered funding incentives and on-bill financing for the balance of project cost, eliminating the need for up front capital investment. The reduction in energy usage and costs, in conjunction with the ability to utilize on-bill financing, ideally results in net-positive cash flow from day one. Once the on-bill financing period has ended (2 to 4 years), the reduction in energy use will result in decreased operational energy costs over the remaining life of the installed measures. Under this program, proposed measures are focused primarily on quick payback energy efficient lighting. Under a Master Agreement between both Eversource and United Illuminating and the Department of Administrative Services (on behalf of all state agencies) the SBEA program was rolled out to state agencies in 2014. In 2015, the Master Agreement was amended to remove the 200kW demand cap to allow for larger energy users to participate in the program, but still keep the 4 year payback. United Illuminating does this on a project-by-project basis, due to their smaller budget than Eversource. These projects must fall below a certain project size to participate in this program, which means this program is effective for some smaller buildings, though not larger facilities.

To date, state facilities have saved an estimated annual cost reduction of \$1 million and electricity use reduction almost of 7 million kilowatt-hours, reducing over 5,000 metric tons of GHG. Figure 7 shows the estimated cost savings per agency.¹¹

¹¹ DEEP will continue to work with Eversource and UIL to get completed data on SBEA projects that are in-development and completed.

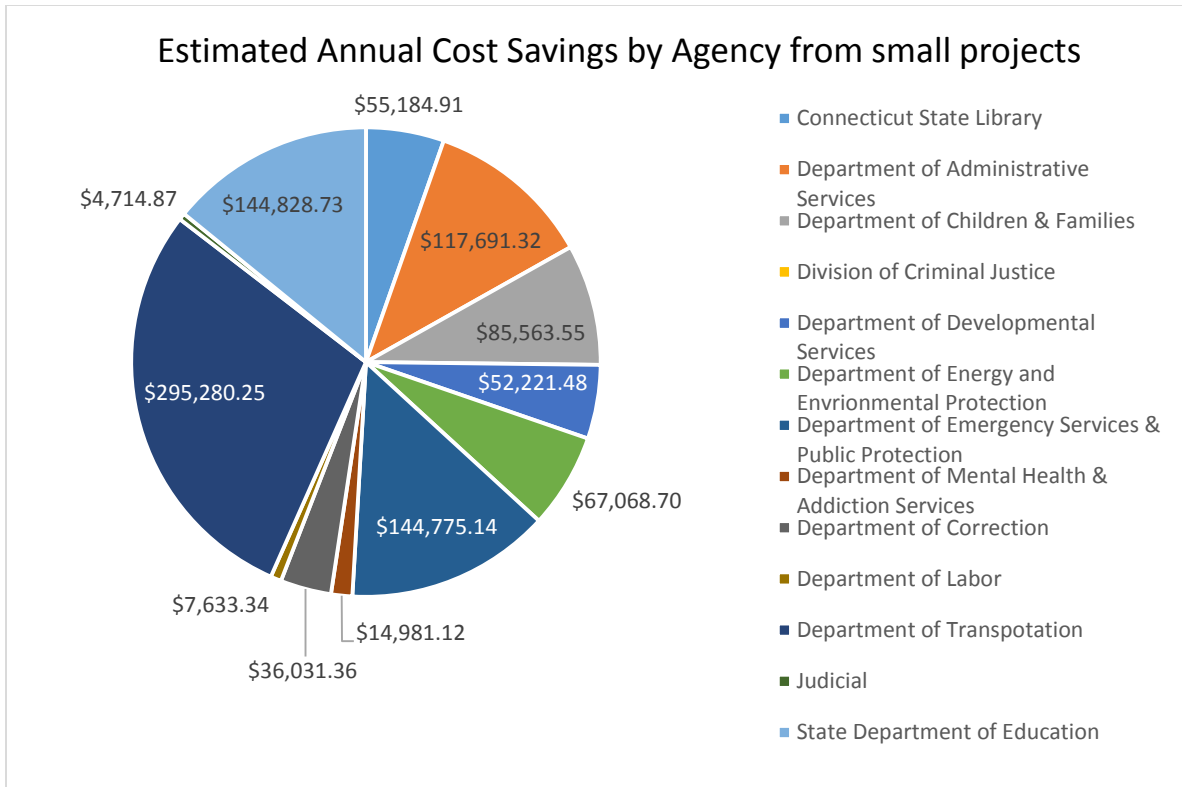


Figure 7: Estimated Annual Cost Savings

Fort Trumbull State Park, New London



The Department of Energy and Environmental Protection participated in the SBEA program at Fort Trumbull State Park in New London in 2014. This project included replacing interior and exterior lights in buildings, along the Fort, and on the Pier. Several burned out lights were replaced and are now functioning. Interactive displays were repaired, exhibit lighting became functional, and motion sensors were installed. The park saw an increase in visitor attendance within the past two years with various events taking place like conferences and weddings. Savings continued to be monitored in 2017.

Figure 8: Fort Trumbull State Park

Medium-Scale Project

In 2011, the State Bond Commission allocated \$15 million in previously authorized bond funds to implement projects to reduce energy consumption in state buildings. Given the success of these investments, in 2015 the State Bond Commission released an additional \$5 million of previously authorized bond funds and \$2 million at

the end of 2017. These funds are supplemented by energy efficiency investments made through the major electricity and natural gas distribution companies in the state: Connecticut Light and Power and Yankee Gas (doing business as Eversource Energy) and United Illuminating, Southern Connecticut Gas, and Connecticut Natural Gas, a part of UIL. The utility investments leveraged the bond funding resulting in additional energy savings.

LBE BOND - FUNDED UPGRADES COMPLETED TO DATE

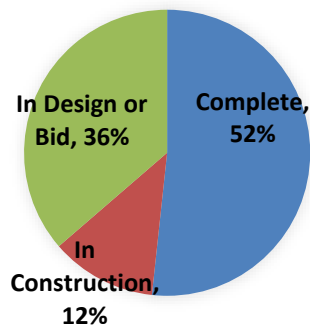


Figure 9: LBE Bond Funds Invested 2012-Present

As of December 2017, the DEEP-led inter-agency process has approved 72 projects to implement energy efficiency in state buildings. Of these, 60 projects have been completed. The cost for all completed projects is \$10.2 million. The estimated cost for the balance of approved projects that are either in construction, the bid process, or design is \$9.5 million. Utility incentives received were estimated to equal nearly \$842,000, prior to the incentives being reduced due to the legislature’s diversion of utility-administered investments. The estimated annual energy consumption savings (electricity, natural gas, and fuel oils) exceed 89,300 million British Thermal Units

(MMBTU), resulting in an **annual cost avoidance of approximately \$2.91 million** (in 2017 dollars). **The estimated simple return on investment for these projects is 8.6 years** (See Figure 9).

Out of the 60 projects completed, 44 projects have a years’ worth of data to see what type of savings have been achieved. Figure 10 shows the before and after energy cost and usage in BTUs for the 44 projects. These projects have saved \$2.6 million, 31,500 MMBTU’s, and reduced GHG emissions by about 71K metric tons to date.

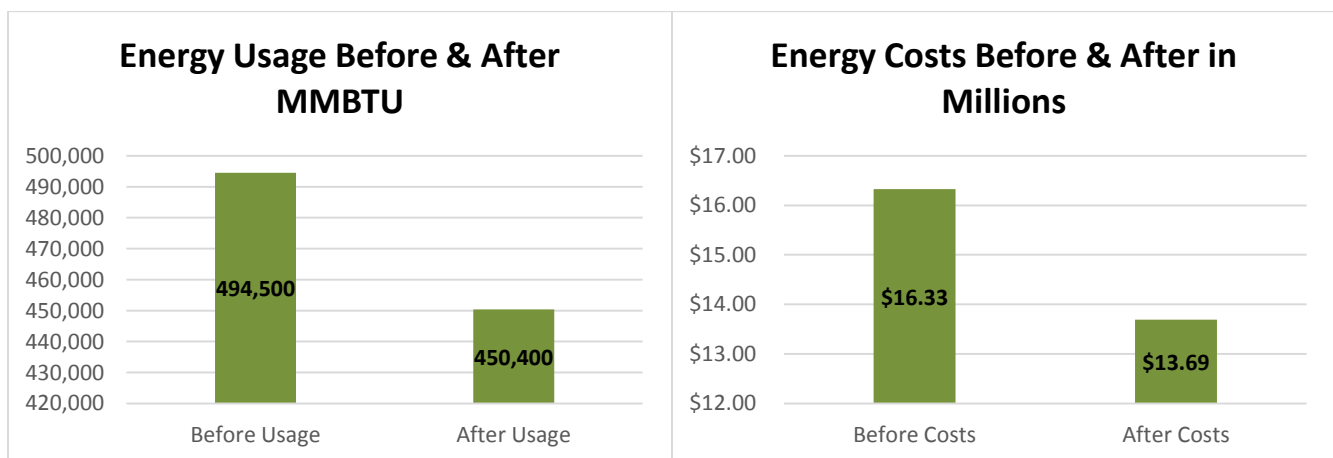


Figure 10: LBE Completed Project Before and After Energy Usage & Cost

All previously authorized and allocated bond funds have been fully committed as of December 2016. The future of the LBE Bond program is dependent upon receipt of additional bond authorizations. This has caused the

program to be on hold until more funding can become available. DEEP will allow state agencies to submit energy efficiency projects for consideration, in case additional bond funds are authorized and allocated. DEEP requested additional bond funds for energy efficiency projects and in the SFY18-19 budget passed October 31, 2017, \$20 million in general obligation bonds was authorized for energy upgrades in SFY 18.¹² Of that \$20 million, \$18 million is anticipated being used by the Department of Correction, leaving \$2 million for mid-sized projects. For information on the list of approved projects, please see the [Lead By Example for State Agencies](#) webpage on DEEPs website or refer to Appendix A in this report.

Department of Correction Robinson Correctional Institution, Enfield is reducing energy costs

In 2015, the Department of Correction submitted a request to DEEP to replace outdated rooftop units at their Robinson Correctional Institution in Enfield, CT, using LBE bond funding. The purpose was to replace the 24 existing HVAC rooftop units with high efficiency gas fired rooftop cooling/heating units with return air enthalpy sensors. The project was estimated to save 213,048 kWh/yr (726 MMBTUs), saving approximately \$32K annually with an additional \$10K in maintenance costs. The project cost was \$275,381.09. The project saved over 3 billion BTU and almost \$143K one year after the project was completed. Figure 11 shows the usage and cost of years' worth of data after project completion.

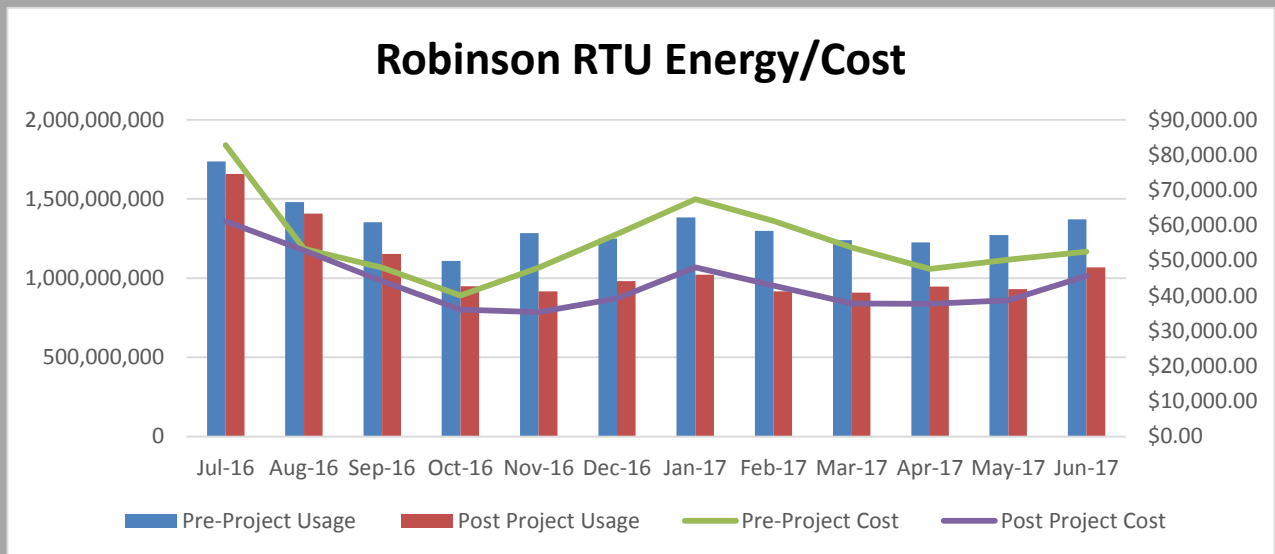


Figure 11: Robinson Correctional Institution Energy Usage & Cost

Large-Scale Projects

Initial projections for comprehensive projects being planned, facilitated, and implemented at the Department of Correction, Connecticut Valley Hospital, and the Department of Motor Vehicles estimate an **investment of approximately \$80 million in energy savings measures across these three agencies, all of which will be paid back within 15 to 20 years, through future energy savings.** The total estimated cost reduction or avoidance is currently estimated at \$6.0 million annually for these three large-scale projects. In consultation with other key agencies, a pipeline of additional large-scale projects for different agencies is in development, contingent upon a sustainable financing mechanism being established, such as through General Obligation Bonds or alternative

¹² [June Special Session Public Act 17-2](#), Section 378(e)(2) for SFY18 and Section 397(d)(2) for SFY19.

financing mechanisms developed by the Connecticut Green Bank, acceptable to OPM and the Office of the Treasurer.

Energy Savings Performance Contracting (ESPC) is a mechanism where a Qualified Energy Service Provider (QESP) contractually guarantees a pre-determined amount of future cost savings over the performance period of certain energy upgrades, based on agreed-upon measures and retrofitting upgrades they will complete at a facility. If such savings are not realized the QESP pays for the difference. These projects are based on transparent pricing and rigorous measurement and verification to ensure the energy performance and cost savings match the guarantees provided by the contractors. Ongoing monitoring is also essential to allow facility managers to verify the effectiveness of improvements and to continuously improve building energy use.

Department of Mental Health and Addiction Services Connecticut Valley Hospital Energy Savings

One example of significant [progress in catalyzing jobs and realizing energy savings](#) is being demonstrated through the CT Valley Hospital energy efficiency project that began construction in 2017. In December 2016, the Department of Mental Health and Addiction Services became the first state executive branch agency to break ground on a Guaranteed Energy Savings Performance Contract project. The project, at the Connecticut Valley Hospital in Middletown, is a comprehensive campus-wide project that will be completed over a multi-year construction period and will result in energy and maintenance savings of \$31.9 million over the 15-year performance period



The upgrades at Connecticut Valley Hospital completed include upgraded boilers and chillers, insulation, lighting upgrades to LED with new lighting controls for interior, exterior. The measures that are planned will reduce the energy use at the campus by 35%, increase patient and hospital staff comfort and safety, address the deferred maintenance on the outdated, failing equipment which will reduce operating costs and greenhouse gas emissions through energy savings. During the construction phase, savings are already being achieved. About 16% of the project is completed, saving over \$58K, over 6,000 MMBtu, and reducing over 600 tons of greenhouse gas emissions. The upgrades are supporting several local prevailing wage jobs in Connecticut, with close to 7,000 job hours.

Figure 12: New central power plant boilers installed

In 2017 difficulties were encountered in the construction phase of one performance contract and the final negotiations of the audit for another potential performance contract, despite Connecticut's having established well-defined programmatic guidelines based on national best practices. This followed significant difficulties encountered in securing financing for performance contracts. As part of ensuring value for the state and maintaining the best interests of the state through contract implementation, DEEP is reevaluating the best path forward to implement large-scale comprehensive projects. DEEP expects to report on lessons learned and next

steps for financing large-scale projects later in 2018.

Purchasing, Funding, and Financing Mechanisms

Financing mechanism for energy efficiency upgrades

DEEP has been working, in collaboration with others, towards a sustainable financing mechanism for small, medium, and large scale projects.

The most important roadblock to investing in energy efficiency at state facilities is the lack of predictable, sustainable source of funding to pay for upgrades. Through the utility companies' implementation of the Conservation and Load Management Plan [CGS 16-245m], agencies are able to complete small-scale upgrades routinely, within operating budgets. Larger scale projects require financing and to date, all financing mechanisms have been interpreted as being subject to the state's debt cap. Until this issue is addressed, significant constraints to large-scale investments remain. DEEP and other key agencies continue to confer with the Connecticut Green Bank to support their efforts to close this financing gap in a way that is acceptable to OPM and the Office of the Treasurer.

In 2017 the Connecticut Green Bank (CGB), in partnership with the utility companies, worked to recapitalize the Small Business Energy Advantage Program to increase the opportunities for small-scale upgrades, as this program is capital constrained. The goal of recapitalizing this program is to use alternative capital sources to lower the costs of, and increase the opportunity for, financing projects for small business, municipal, and state facilities. This effort began in 2016, with a goal to find low-cost capital to fund SBEA loans while maintaining the current aspects of the program. Jointly, the CGB and Utilities issued a Request for Proposals (RFP) for private capital to deliver interest rate buy-down savings, and also provide capital to allow UIL to avoid rationing their investments in public sector projects. The RFP was issued in December 2016 to 13 capital providers, and JP Morgan was selected for providing the cheapest cost of capital and being the most flexible solution. However, implementation difficulties indicated a need to re-evaluate the approach and further work continues on this effort into 2018.

DEEP received authorization for \$20 million in General Obligation (GO) Bonds for State Fiscal Year 18 and \$20 million in GO Bonds for State Fiscal Year 19 in the budget that was passed in the fall of 2017.¹³ Of that \$20 million, \$18 million is anticipated to be used by the Department of Correction, and \$2 million will be used for mid-sized projects. Since the initial \$20 million GO Bonds were fully expended at the end of 2016, several agencies have come forward looking to do energy upgrades at their facilities using the Lead by Example Bond Funded Program. This funding will help agencies to complete mid-size projects that are too big for the SBEA program and too small to participate in an ESPC Project.

DEEP has been working with OPM, DAS, and the Office of the State Treasurer (OTT), and the Connecticut Green Bank regarding financing large-scale comprehensive projects, including Energy Savings Performance Contracts. There have been several inter-agency task meetings at the commissioner level and at the staff level to discuss the various financing mechanism to fund large comprehensive projects that address deferred maintenance of energy systems. The approach to financing will continue to be evaluated in 2018.

¹³ [June Special Session Public Act 17-2](#), Section 378(e)(2) for SFY18 and Section 397(d)(2) for SFY19.

Diversion of utility companies' energy efficiency investment funding

A significant setback for state facilities energy efficiency investments occurred in 2017 with the passage on October 31, 2017 of the state's budget¹⁴ that diverted \$63.5 million in SFY18 and \$63.5 million in SFY19¹⁵ from the funding used to implement the statewide *Electric and Natural Gas 2016-2018 Conservation and Load Management Plan*. Among other problematic results of this diversion, the reduced investments in energy efficiency that would otherwise have occurred through the utility companies' programs means fewer projects will be completed at state facilities in SFY18 and SFY19.

Planning for future projects

DEEP has been prioritizing state buildings and assessing what buildings are in dire need of energy retrofits to reduce energy waste and opportunity costs. In 2017 DEEP coordinated with DAS to prioritize DAS buildings to identify how scarce resources can be optimized. For example, DAS identified several state buildings that are in need of lighting retrofits that can participate in the SBEA program, using utility investments as the primary catalyst for funding, as well as identifying facilities for energy assessment scoping studies that the utility companies can complete, and helping plan aggregated purchases of standardized energy efficient equipment that can be used at multiple facilities with optimized pricing. DEEP continues to encourage agencies to pursue energy retrofit opportunities and identifying their energy management needs in their capital plans.

During 2017 as new funding did not become available DEEP encouraged agencies to continue to request funding from the LBE Bond Funded program, to be in queue when more funding becomes available. There have been several inquiries from agencies seeking funding for the LBE Bond Funded program.

Aggregated Electricity Supply Procurement for all Agencies

In 2017 the Department of Energy and Environmental Protection and the Department of Administrative Services conducted a competitive procurement to acquire a new contract for electricity supply for all state facilities beginning in July 2017. This aggregated purchasing structure advances Governor Malloy's vision of cleaner, cheaper, and more reliable energy for Connecticut. The electricity supply for state facilities will meet the Renewable Portfolio Standard required by state law [CGS 16-245a], which means that a portion of the supply will be from clean renewable energy sources such as solar and wind. The contract for the supply of electricity for state accounts was awarded to Direct Energy Business, LLC.

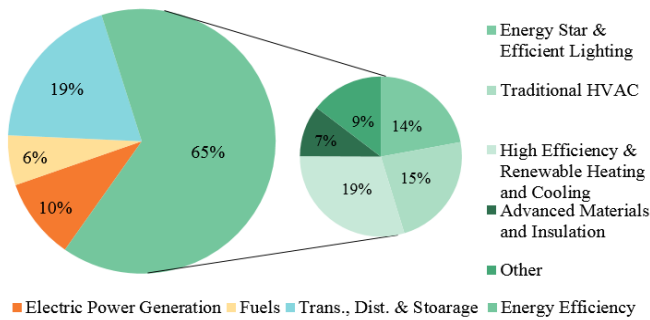
State accounts are estimated to consume approximately 300 million kilowatt hours, not including UConn and the state colleges and universities, which have their own contract. The accounts include executive branch agencies, and judicial and legislative management branch buildings, as well as Metro North, and some other quasi-public agencies. Approximately 80% of state accounts are in Eversource service territory and 20% in United Illuminating service territory. Based upon Standard Service rates estimated for the period from July 1, 2017, through June 30, 2018, for each of the service territories compared to the price of \$0.07533/kwh obtained through this competitive bidding process, the state estimates savings of more than \$1 million for the state fiscal year that runs July 1, 2017 through June 30, 2018. DEEP along with DAS and PURA's Procurement manager are

¹⁴ On October 31, 2017, [June Special Session Public Act 17-2](#), *An Act Concerning the State Budget for the Biennium Ending June 30, 2019, Making Appropriations Therefor, Authorizing and Adjusting Bonds of the State and Implementing Provisions of the Budget* ("June SS P.A. 17-2"), became law, effective on passage. The public act identified the diversion of utility-collected charges on electric bills to address the state budget deficit. These diversions included redirection of a total of \$63.5 million from the conservation mill charge on electric ratepayers' bills and a portion of Connecticut's revenue from RGGI auctions, reducing by \$68 million per year the funds available to implement the Plan in calendar years 2018 and 2019.

¹⁵ In 2018 the amount of the diversion in SFY19 was reduced to \$53.5 million.

evaluating opportunities for savings from conducting an aggregated procurement for natural gas accounts for state facilities. DEEP expects to report back on next steps in the 2018 annual report.

Workforce Development



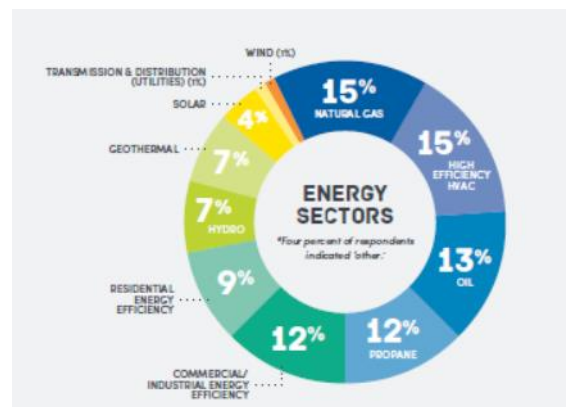
Source: U.S. Department of Energy, 2017

In 2017 DEEP continued to partner with the Connecticut Business and Industry Association’s Education and Workforce Partnership to support further development of Connecticut’s energy workforce and employment opportunities. Through the CBIA Partnership, DEEP has provided funds from a federal grant for administrative support of the Connecticut Energy Workforce Development Consortium, a public-private partnership of representatives from energy-related businesses, government and academia, and to support enhancements of their website, www.GetIntoEnergyCT.com.



Source: 2017 Survey of Energy and Energy Efficiency Workforce Needs, CT DEEP/CBIA

Connecticut’s energy efficiency industry included 34,000 jobs in 2017, according to the U.S. Department of Energy in its US Energy and Employment Report www.energy.gov/downloads/2017-us-energy-and-employment-report. The largest number of these employees work in high efficiency HVAC and renewable heating and cooling firms.



Source: 2017 Survey of Energy and Energy Efficiency Workforce Needs, CT DEEP/CBIA

With a U.S. Department of Energy grant, DEEP commissioned the CBIA Education and Workforce Partnership to develop and implement a survey of energy and energy efficiency workforce needs. The 2017 Survey of Energy & Energy Efficiency Workforce Needs highlighted the difficulty experienced by a majority of Connecticut’s employers in finding entry-level workers for jobs related to energy or energy efficiency. Of the respondents to the survey, 73 % identified “lack of required technical skills/certifications” as the biggest barrier related to hiring entry-level employees. Despite the workforce efforts of a variety of stakeholders and industry leaders, workforce efforts have been undermined through the Legislature’s diversion of the utility

collections used to fund the Conservation and Load Management Plan as the reduced funding has cut deeply into the Plan’s workforce development investments, including a 50% reduction in workforce education and training offerings to advance the skills of clean energy technicians and building operators. Energy efficiency companies have been significantly affected by the diversion of Conservation and Load Management Plan funding, with budget uncertainty and volatility limiting investments in workforce training and the reduced capital investments resulting in layoffs at several companies that provide energy efficiency services to residents and businesses throughout the state.

To enhance the options for energy-related training in Connecticut, in 2017 DEEP contributed federal grant funds to the Tunxis Community College AAS Degree program in Energy Management that has been developed to close a gap in workforce training and advance workforce opportunities for trained energy technicians.

[\[www.tunxis.edu/completion/energy-management\]](http://www.tunxis.edu/completion/energy-management).



The A.A.S. Degree in Energy Management

The Applied Associate of Science Degree in Energy Management is a unique two-year technical training program that prepares you for a rewarding career in commercial building energy analysis and energy management.

Students evaluate energy use patterns; develop, implement, market and maintain conservation programs; perform public outreach; recommend energy efficiency techniques; integrate alternative energy sources; and perform systems analysis to solve problems.

You will apply basic physics and analytical techniques to measure and define energy use of today’s building systems with the goal of evaluating and recommending alternative energy solutions that will result in greater energy efficiency and lower energy costs. Students need no prior experience to succeed in the program.

Climate change, and our need to reduce energy consumption in buildings, has created new job and career opportunities for energy professionals.

Source: www.tunxis.edu/completion/energy-management

Renewable Energy

Transitioning to renewable energy generation is consistent with the state’s Comprehensive Energy Strategy and environmental goals. While several state facilities have installed on-site generation capacity from renewable energy sources such as solar and geothermal systems, the primary challenges in widespread installation of renewable energy generation sources, at state facilities has been ensuring that financing for renewable installations is available and that financed pricing is cost-competitive compared with the very competitive price of the state’s aggregated electricity supply. It is important to note that favorable tax incentives have subsidized increased solar generation capacity in Connecticut at residential and private commercial properties in recent years. However, as a tax-exempt organization, the state is not able to directly benefit from tax incentives. Therefore, government sector facilities interested in on-site generation capacity but lacking funding for capital costs and associated maintenance costs may seek financing through power purchase agreements (PPAs). Such agreements hold the developer responsible for supplying the capital for project development and maintenance and the facility enters into a long-term agreement to purchase power from the private developer, while the developer benefits from the tax credits that the government entity cannot claim.

In 2017, DEEP worked in partnership with the Connecticut Green Bank and Connecticut’s Attorney General’s Office (AGO), to complete the development of standardized documents that meet contracting requirements for Executive Branch state agencies to install renewable energy at their facilities. Specifically, DEEP and the AGO have been developing standard Power Purchase Agreement, Interconnection, and Virtual Net Metering documents. A standard process is anticipated to be in place by the end of 2018. Once the documents and processes have been approved, the financing agreements will be finalized. The CT Green Bank and/or the

Department of Administrative Services will then competitively procure service providers willing to enter into Power Purchase Agreements that pay for the development and installation of solar generating capacity at selected facilities.

The Connecticut State Colleges and Universities have different contracting requirements and have been installing solar PV systems at various Community Colleges and State Universities. Some of these systems will be ground mount, rooftop, and/or parking lot canopy solar PV. Some campuses that are currently under contract include Middlesex Community College, Manchester Community College, and Southern Connecticut State University for solar installation. All are expected to be operational at some point in 2018.

RECOMMENDATIONS

To build on the success of the achievements in energy use reduction to date, DEEP recommends the following:

1. **Identify funding** or financing mechanisms for agencies that have prioritized **facilities awaiting funding for energy upgrades** (DAS, DOC, DMV, DMHAS, DVA, DEEP, Military, Judicial, Military).
2. **Ensure financing is institutionalized** for all types of energy efficiency projects through:
 - a. **regular authorizations and allocations of bonds to fund** pipeline of upgrades; and
 - b. **non-bond financing acceptable to the Office of the Treasurer, and the Office of Policy and Management**, such as financial mechanisms developed by the Connecticut Green Bank, and mechanisms developed by utility companies.
3. **Continue the collaborative inter-agency process to support the on-going development of a pipeline** of small, mid-size, and large-scale comprehensive energy upgrade projects, using the information from benchmarking and feasibility analyses, and integrating energy efficiency, renewable energy generation, and energy storage opportunities as applicable.
4. **Continue to invest in energy data management**, which includes completing electronic data transfer between UIL and the state.
5. Work with Utility companies, EnergyCAP, OPM, the Office of the State Comptroller, and other agencies to **optimize streamlining opportunities** for agencies that are potentially available through the successful **transfer of electronic utility data**.
6. Continue to support all branches of state government, UCONN, CSCU, and quasi-public agencies on reporting their energy consumption and expenditures to analyze and strategize energy management decisions, to **ensure compliance with state law**.
7. **Concurrently benchmark state buildings**, while accounts to buildings correlations are being completed.
8. Coordinate with the CT Department of Labor to **institutionalize funding for clean energy workforce development**.

Appendix A: State Facilities Energy Efficiency Bond Funded Projects

Lead By Example - State Facilities

Approved Bond Funded Projects as of December 19, 2017

ID	Agency	Building Address	Project Name	Estimate or Actual Annual Energy Reduction (BTU)	Estimated or Actual Annual Energy Cost Reduction	Estimated or Actual Project Cost	Simple Payback (yrs.)	Project Status
30	DAS	18/20 Trinity Street	Replace VFDs and Pumps - Tie into BMS	20,989,950	\$4,880.71	\$16,243.00	3.33	Complete
31	DAS	30 Trinity Street	VFD Installation and Tie into BMS	19,112,800	\$2,729.92	\$24,468.00	8.96	Complete
32 & 111	DDS	67-87 Mountain Rd Newington CT 06111	Installation of EMS	(29,077,512)	\$7,403.63	\$134,834.00	18.21	Complete
33	DDS	146 Silvermine Road Norwalk, Ct 06850	Installation of EMS	(975,547,636)	(\$43,983.76)	\$86,184.00	(1.96)	Complete
34	MHA	1635 Central Avenue, Bridgeport, CT 06610	Control System/Gas Condensing Boilers/Condensers	846,814,424	\$115,495.00	\$1,198,737.00	10.38	In Process
37	DOC	285 Shaker Road, Enfield, CT 06082	Robinson HVAC Rooftop Replacement	447,744,644	\$136,687.00	\$401,214.20	2.94	Complete
28 & 38	DAS	505 Hudson Street, Hartford CT	High Efficiency Gas Fired Boilers	(392,526,540)	\$61,071.20	\$137,100.00	2.24	Complete
39	DDS	195 Alvord Rd Torrington CT 06850	Installation of EMS	(953,768,956)	(\$10,996.26)	\$67,485.00	(6.14)	Complete
42	DOC	391 Shaker Road, Enfield	HVAC Rooftop Unit Replacement	(67,120,058)	\$16,752.00	\$150,690.00	9.00	Complete
43	DAS	79 Elm Street, Hartford, CT 06106	VAVs/FTUs/VFDs	1,371,206,880	\$123,426.63	\$349,750.00	2.83	Complete
44	OPM	615 Silver Lane East Hartford, CT 06118	Aggregated Efficiency Measures Project	3,888,814,704	\$254,628.22	\$280,702.10	1.10	Complete
50	DDS	1450 S Britain Rd Southbury CT	Lighting at Power House	1,798,132,224	\$210,237.88	\$13,811.18	0.07	Complete

ID	Agency	Building Address	Project Name	Estimate or Actual Annual Energy Reduction (BTU)	Estimated or Actual Annual Energy Cost Reduction	Estimated or Actual Project Cost	Simple Payback (yrs.)	Project Status
77	DAS	401 West Thames Street, Norwich, CT	Uncas Domestic Hot Water Boiler	492,114,829	\$2,645.17	\$12,850.00	4.86	Complete
79	DAS	401 West Thames Street, Norwich, CT	Uncas Control Valves	685,270,665	\$6,701.49	\$16,780.00	2.50	Complete
80	DAS	401 West Thames Street, Norwich, CT	Uncas TVCCA Windows	139,170,954	\$9,854.61	\$98,978.40	10.04	Complete
81	JUD	1 Courthouse Square, Norwich, CT 06360	LED Lighting Retrofit	106,485,600	\$19,119.28	\$15,595.00	0.82	Complete
1	ECSU	High Street, Willimantic, CT 06226	ECSU - Allerton Building Automation System	2,043,324,595	\$78,819.19	\$709,818.00	9.01	Complete
19	AES	123 Huntington Street, New Haven, CT 06511	Windows	829,468,238	\$31,921.00	\$209,574.00	6.57	Complete
21	AES	123 Huntington Street, New Haven, CT 06511	Dual Fuel Burners	(78,851,964)	\$1,043.44	\$46,900.00	44.95	Complete
24	AES	153 Cook Hill Road, Windsor, CT 06095	Lighting & Occupancy sensors	2,354,970	\$469.59	\$9,123.12	19.43	Complete
25	AES	123 Huntington Street, New Haven, CT 06511	Windows	581,872,376	\$23,988.00	\$210,426.00	8.77	Complete
26	DAS	24-38 Wolcott Hill Road, Wethersfield, CT 06109	EMS, RA Conversion, Central Plant Fixture Replace	6,292,267,021	\$152,988.00	\$915,453.00	5.98	In Process
27	DAS	110 Sherman Street, Hartford CT	Digital Electronic Control System	(74,048,448)	\$3,387.22	\$308,522.00	91.08	Complete

ID	Agency	Building Address	Project Name	Estimate or Actual Annual Energy Reduction (BTU)	Estimated or Actual Annual Energy Cost Reduction	Estimated or Actual Project Cost	Simple Payback (yrs.)	Project Status
85	DAS	165 Capitol Avenue, Hartford	SOB - Occupancy Sensors, Basement, Ground, First	323,955,395	\$14,241.34	\$57,427.46	4.03	Complete
87	MHA	500 Vine Street, Hartford	Hot Water DDC Controls	187,175,746	\$26,040.00	\$131,732.00	5.06	Complete
91	DMV	173 Salem Turnpike, Norwich, CT	Lighting upgrade	4,959,089	\$3,744.80	\$12,316.81	3.29	Complete
92	CRDA	100 Columbus Boulevard, Hartford	Convention Center Retro-Commissioning Upgrade	2,720,297,520	\$83,569.74	\$406,701.00	4.87	Complete
94	DOT	Various locations located throughout the State of Connecticut	Energy Efficiency Improvements at DOT Commuter Parking	855,150,526	\$32,172.00	\$345,000.00	10.72	Complete
96	JUD	1 Court Street, Middletown, CT 06457	Middletown Courthouse Garage Lighting Retrofit	524,508,475	\$52,326.21	\$55,630.80	1.06	Complete
103	BOR	55 Paul Manafort Drive, New Britain CT 06053	Charter Oak -Occ. Sensor Install and HVAC Upgrades	22,389,280	(\$2,158.98)	\$25,309.00	(11.72)	Complete
104	Deep	141 Trout Hatchery Road, Central Village, (Plainfield) CT 06332	Quinebaug Valley Trout Hatchery Phase I	6,450,435,782	\$55,879.61	\$304,780.00	5.45	In Process
105	JUD	172 Golden Hill Street, Bridgeport	GA 2 Lighting Retrofit	(32,764,800)	\$11,606.16	\$216,600.00	18.66	Complete
109	JUD	1061 Main Street, Bridgeport	Fairfield JD Lighting Retrofit	438,229,200	\$46,910.30	\$253,631.00	5.41	Complete
113	DCS	1000 Silver Street	DCS Juvenile Training School Fuel cell Study			\$21,000.00	0.00	Complete

ID	Agency	Building Address	Project Name	Estimate or Actual Annual Energy Reduction (BTU)	Estimated or Actual Annual Energy Cost Reduction	Estimated or Actual Project Cost	Simple Payback (yrs.)	Project Status
119	MHA	1000 Holmes Drive, Middletown, CT 06457	RVS - Dutton Home Attic Insulation	1,410,502,818	\$14,214.85	\$16,500.00	1.16	Complete
122	JUD	400 Grand Street, Waterbury, CT 06702	Waterbury Courthouse Garage Lighting Retrofit	1,991,311,437	\$126,179.39	\$59,972.45	0.48	Complete
123	JUD	231 Capitol Avenue, Hartford, CT 06106	Supreme Court/State Library Lighting Retrofit	(481,936,078)	\$34,140.02	\$53,147.80	1.56	Complete
126	MHA	162 Cedar Lane, Middletown, CT 06357	CVH - Water Treatment Plant - Pump Upgrades	107,219,395	\$5,409.54	\$71,073.70	13.14	Complete
127	DMV	150 Torrington Road, Winsted, CT 06098	Lighting and Occupancy Sensors	4,959,089	\$2,757.00	\$30,606.99	11.10	Complete
128	AES	123 Huntington Street, New Haven, CT 06511	CAES - Exterior Lighting Upgrades	341,214,000	\$6,400.00	\$19,875.08	3.11	Complete
130	DEEP	422 Watertown Road, Thomaston, CT 06787	Thomaston Garage - Lighting and HVAC Upgrade	(47,077,279)	\$1,314.39	\$32,097.00	24.42	Complete
146	DAS	50 & 55 Farmington Avenue, Hartford	Mechanical Renovations 55 Farmington Ave	2,258,645,584	\$212,072.24	\$662,817.40	3.13	Complete
147	DAS	50 & 55 Farmington Avenue	DAS 55 Farmington Ave-Light/Cool	263,323,872	\$6,482.57	\$520,532.00	80.30	Complete
180	DOC	177 Weston Street, Hartford, CT 06120	Hartford CC Roof Top Unit Replacement	484,646,277	\$26,209.00	\$338,509.00	12.92	Complete
158	DDS	67-87 Mountain Rd Newington CT 06111	DDS HRC Mechanical Systems Energy Upgrades	2,036,333,677	\$51,276.00	\$369,132.00	7.20	In Process

ID	Agency	Building Address	Project Name	Estimate or Actual Annual Energy Reduction (BTU)	Estimated or Actual Annual Energy Cost Reduction	Estimated or Actual Project Cost	Simple Payback (yrs.)	Project Status
175	JUD	20 Franklin square, New Britain, CT 06051	New Britain Retro-Commissioning	1,114,976,460	\$75,558.02	\$97,382.00	1.29	Complete
177	SDE	600 Orange Ave Milford CT 06460	Platt Tech Shop Lighting and Weather -stripping	394,344,846	\$42,801.44	\$74,481.50	1.74	Complete
178	DOC	285 Shaker Road, Enfield, CT 06082	2015 Lighting Upgrade - Library and Gym Areas	1,304,796,726	\$124,898.47	\$28,480.37	0.23	Complete
155	CRDA	100 Columbus Blvd., Hartford, CT 06103	LED Lighting	1,975,717,440	\$202,419.60	\$1,805,825.90	8.92	Complete
160	JUD	95 Washington Street, Hartford, CT 06106	Retro Commission Program	1,883,712,744	\$39,082.00	\$134,618.00	3.44	In Process
163	DOC	59 Hartford Road, Brooklyn, CT 06234	Chiller Replacement	710,177,040	\$31,566.17	\$171,800.00	5.44	Complete
167	DOC	986 Norwich-New London Turnpike, Uncasville, CT 06382	Chiller Replacement	244,302,540	\$142,702.22	\$95,300.00	0.67	Complete
168	DEEP	141 Trout Hatchery Road, Central Village, (Plainfield) CT 06332	Quinebaug Trout Hatchery Phase II	6,450,435,782	\$232,790.00	\$2,512,479.00	10.79	In Process
169	SDE	600 Orange Avenue, Milford	Platt Tech Lighting	184,302,000	\$16,109.37	\$97,960.89	6.08	Complete
179	MHA	51 Coventry Street, Hartford	Boiler Replacement & Heating System Upgrades	(214,433,334)	\$5,583.08	\$96,790.00	10.30	Complete
181	DOC	177 Weston Street, Hartford, CT 06120	Boiler Room Pump Replacement	303,591,744	\$13,348.00	\$44,117.94	3.30	Complete
182	JUD	111 Phoenix Ave, Enfield	Roof and HVAC Upgrades	1,748,578,285	\$66,763.37	\$760,000.00	11.40	In Process

ID	Agency	Building Address	Project Name	Estimate or Actual Annual Energy Reduction (BTU)	Estimated or Actual Annual Energy Cost Reduction	Estimated or Actual Project Cost	Simple Payback (yrs.)	Project Status
183	DOC	285 Shaker Road, Enfield, CT 06082	Laundry Consolidation and Upgrades	5,326,087,991	\$119,826.00	\$302,326.00	2.20	Complete
186	DOT	2800 Berlin Turnpike, Newington	Headquarters Building Lighting Improvement	5,770,958,523	\$265,141.56	\$1,332,083.00	5.00	In Process
187	DOC	285 Shaker Road, Enfield, CT 06082	Rooftop Unit Replacement	3,143,676,757	\$142,785.00	\$294,252.67	9.20	Complete
188	DOC	900 Highland Ave, Cheshire	A&B Dining Areas Roof Top Unit Replacement	817,157,525	\$62,201.00	\$59,832.91	9.00	Complete
189	DDS	67-87 Mountain Rd Newington CT 06111	RTU AC and Window Replacement HRC	346,731,430	\$17,274.91	\$164,963.00	11.60	Complete
190	DOC	986 Norwich-New London Turnpike, Uncasville, CT 06382	Radgowski Kitchen Hood Controls	1,868,370,522	\$21,137.00	\$23,367.00	3.20	Complete
195	DOC	201 West Main Street, Niantic, CT 06357	Laundry Ozone System	(875,868,092)	\$204,551.00	\$38,090.00	1.40	Complete
199	DOC	285 Shaker Road, Enfield, CT 06082	2016 Exterior Lighting Upgrade	798,372,517	\$39,177.00	\$171,996.00	4.30	Complete
200	DOC	Osborn, 335 Bilton Rd, Somers, CT 06071 Enfield, 289 Shaker Rd, Enfield, CT 06082	Osborn/Enfield Correctional Steam Trap Replacement	8,444,880,699	\$59,825.00	\$53,739.00	0.90	Complete
Totals				78,598,552,910	\$3,945,595.55	\$17,779,514.67	Avg. Payback 8.65	

Appendix B: Overview Presentation of 2017 Update of State Buildings Energy Management

2017 Highlights



Achieved key progress in energy analytics
Established electronic data flow from utilities to state platform for analyzing energy



Purchased competitive electricity supply for all agencies at pricing below standard offer

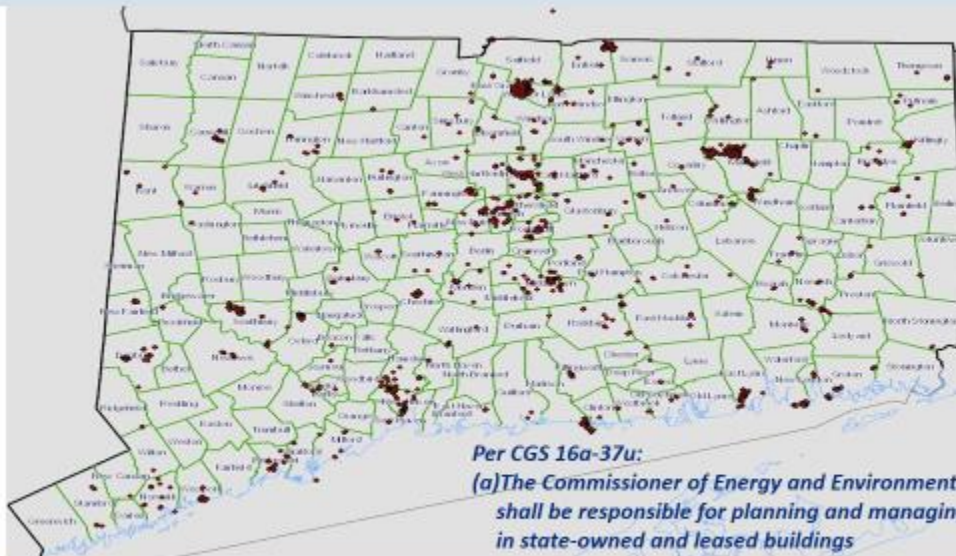


Progress installing upgrades at CT Valley Hospital campus;
Bond funding for major efficiency upgrades fully expended in 2017;
Multiple agencies successfully completed minor efficiency upgrades



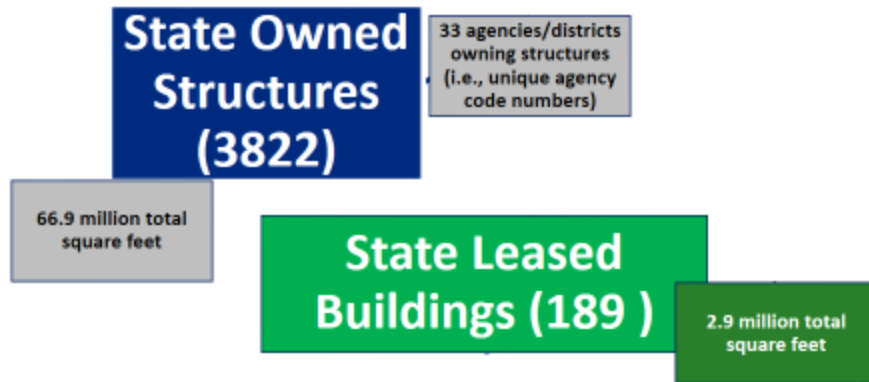
Connecticut Department of Energy and Environmental Protection

Many State Facilities = Many Opportunities to Improve Energy Use



Connecticut Department of Energy and Environmental Protection

~70 million square feet of state structures

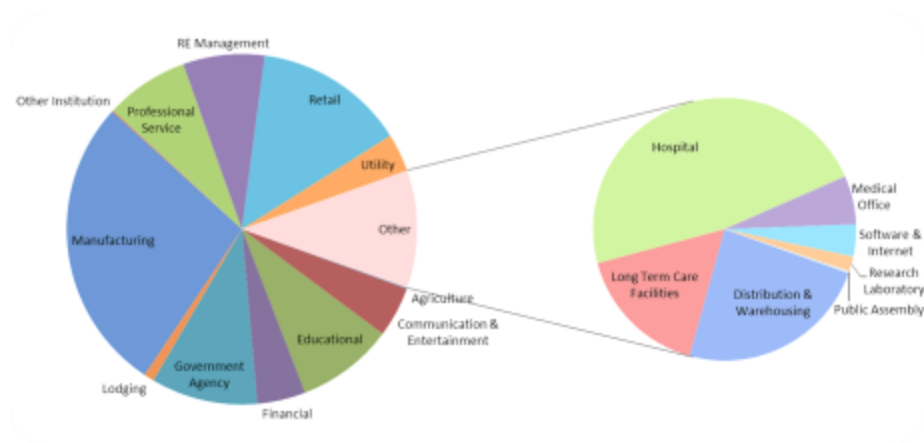


Source: CT Office of Policy and Management, JESTIR database 2017



Connecticut Department of Energy and Environmental Protection

Context: CT Government buildings are 11-15% of Commercial & Industrial sector electricity consumption



Source: Eversource Data and Graphic, 2015



Connecticut Department of Energy and Environmental Protection

Advantages of Energy Planning

Tracks energy cost and consumption down to the building level for all state agencies.

Allows agencies to track energy and greenhouse gas data.

Creates target goals for reducing energy consumption.

Ensures the ability to measure energy savings.

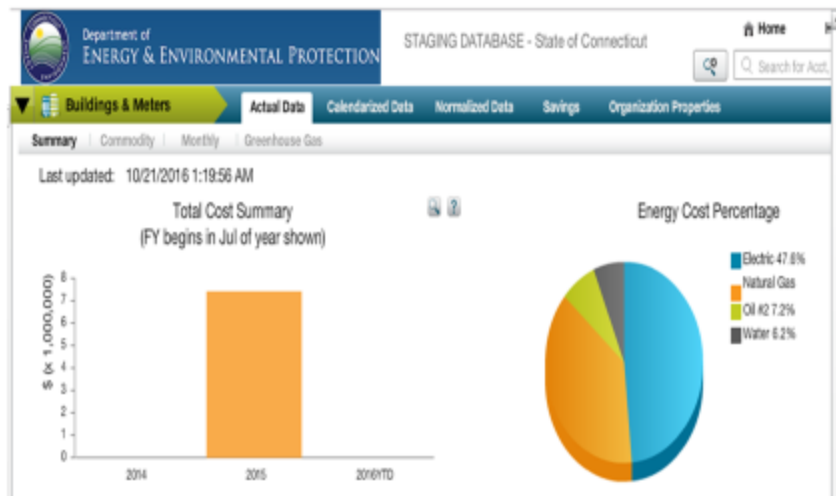
Can identify savings opportunities related to energy billing.

CT DEEP plans and implements actions to improve energy management in state buildings consistent with CGS 16a-35k and 22a-1a, pursuant to CGS 16a-6, CGS 16a-37t, 16a-37u, 16a-37x, 16a-38a, 16a-38b, 16a-38i, 16a-38l, and 16a-39b.



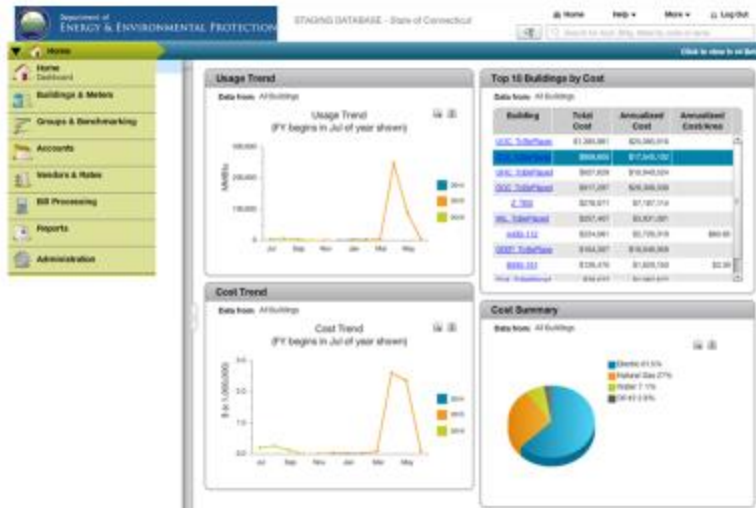
Connecticut Department of Energy and Environmental Protection

Agency Analyses



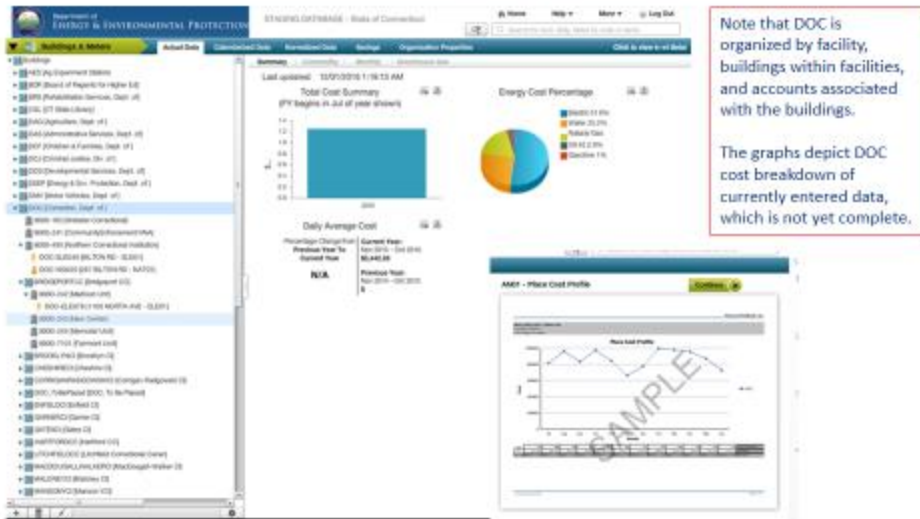
Connecticut Department of Energy and Environmental Protection

Analyze Usage Trends by Agency and Building



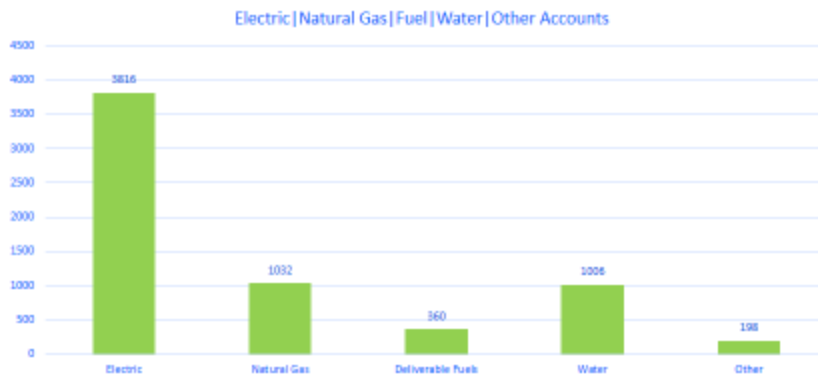
Connecticut Department of Energy and Environmental Protection

Analyze Cost Trends by Agency and Building



Connecticut Department of Energy and Environmental Protection

State Energy Accounts by Commodity*



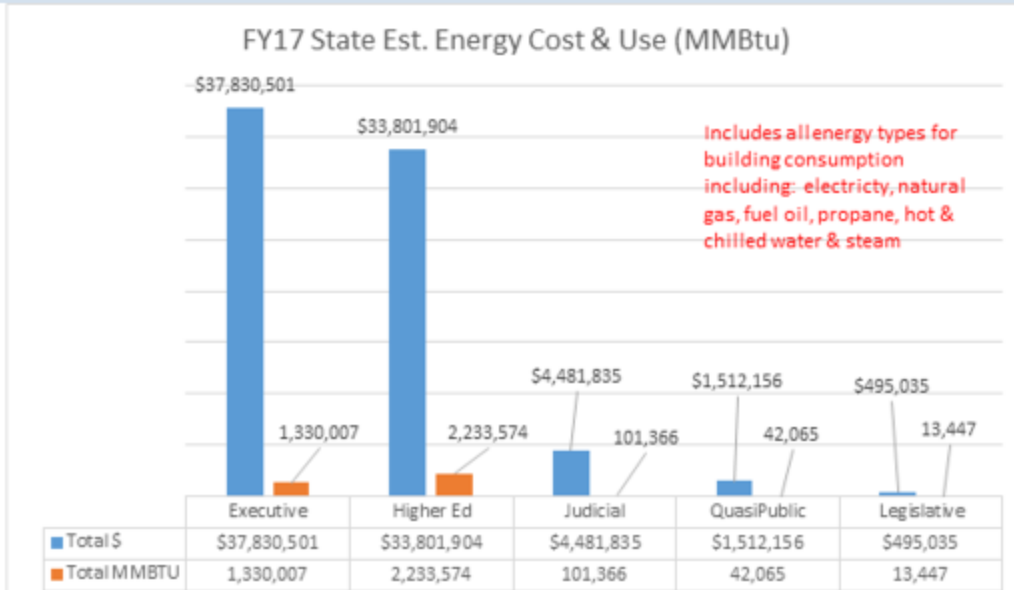
Estimated 611 million Annual total kWh | 2.5 million DTh Natural Gas

**Based on Best Estimates from CT DEEP data from state fiscal year 2017; data not complete*



Connecticut Department of Energy and Environmental Protection

State Agencies' Annual Energy Consumption and Spending

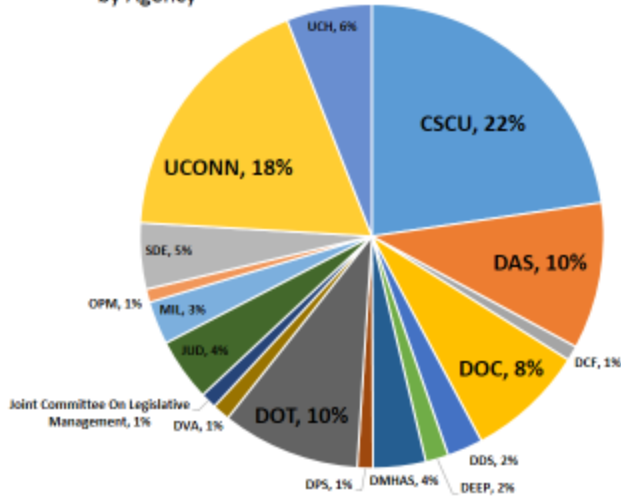


Connecticut Department of ENERGY & ENVIRONMENTAL PROTECTION

Connecticut's State Government Real Estate [square feet]

- Approximately 70 million square feet
- Roughly 3800 buildings
- Nearly ½ are educational facilities [UCONN, CSCU, CT Technical High School System]

Gross Square Feet of Floor Space by Agency



Source: CT Office of Policy and Management, JESTIR database 2017

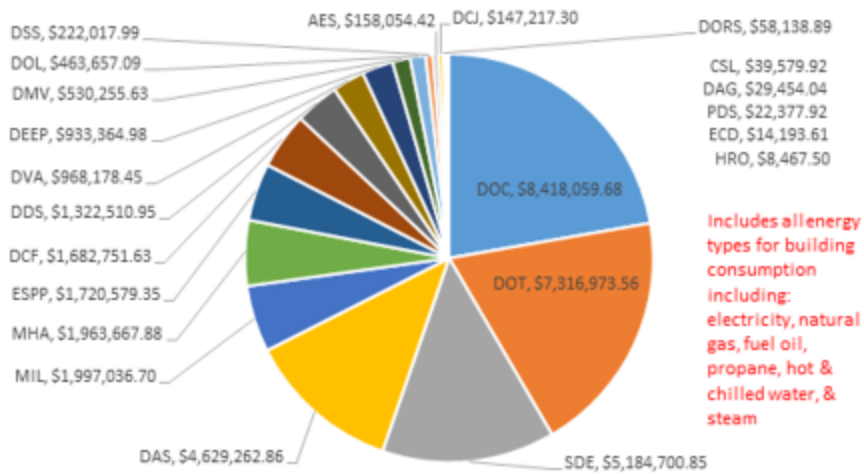


Connecticut Department of ENERGY & ENVIRONMENTAL PROTECTION

Connecticut's Annual Energy Spending (\$) [excluding UCONN & CSCU]

- Executive Branch Agencies
- ¼ is State Department of Education [Technical High School System]
- Aside from SDE, these agencies: DOC, DOT, and DAS-managed buildings, have the largest energy bills

FY17 Executive Branch Est. Energy Costs by Agency



Source: CT DEEP, 2018 analysis of CY2017 available data



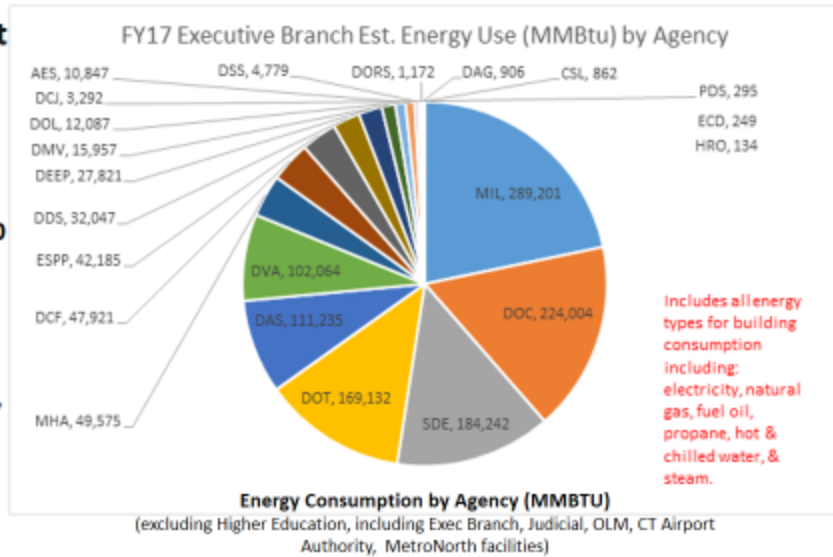
Connecticut Department of ENERGY & ENVIRONMENTAL PROTECTION

Connecticut's Energy Consumption by Agency (MMBTU)

- The average energy cost per square foot in state buildings is **\$3.93**.

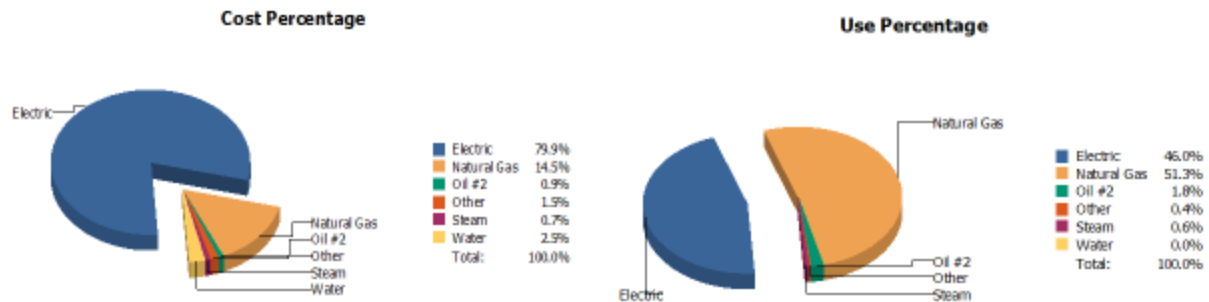
- There are **243** state owned or leased buildings of at least **10,000 sq.ft.** These are located in the following agencies:

JUD (42), DAS (36), MIL (31), UOC, (28), CCSU (22), DVA (14), SDE (11), DEEP (9), MHA (7), DOT (6), OLM (5), DOL (5), DMV (4), DOC (4), CSL (3), DCF (3), DDS (3), & AES, DAG, DSS, ESPP, & UHC with 2 each



Connecticut Department of ENERGY & ENVIRONMENTAL PROTECTION

State Agencies' Total SFY17 Percentage of Energy Cost & Consumption*



**Snapshot of the information currently available, the data is not 100% complete*



Connecticut Department of ENERGY & ENVIRONMENTAL PROTECTION

State Facilities Analyses: Examples of Buildings with High Energy Costs

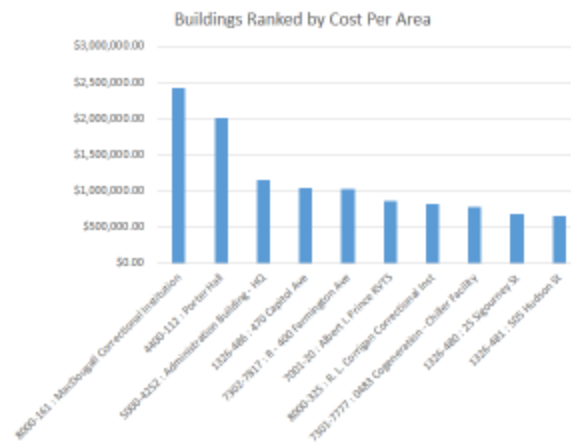
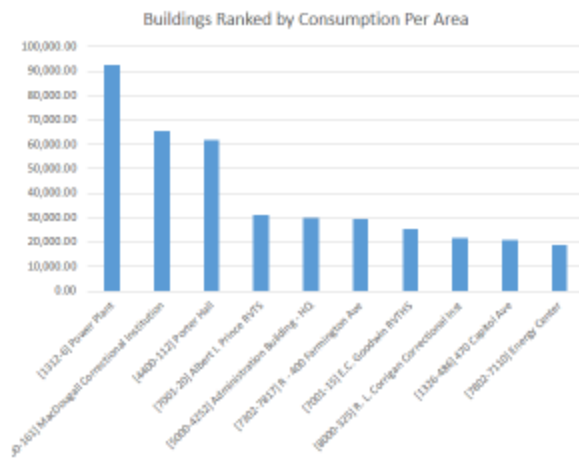
Top 25 Buildings by Estimated Annualized Cost (less Higher Education)						
Building Name	Location	ID	Agency		Sq. Ft.	Est. Annualized Cost
Hangar - TASMG	CTNG - TASMG Groton	2201-46	MIL	Owned	126,841	\$3,231,078.89
MacDougall Correctional Institution	MacDougall Ct, Suffield	8000-181	DOC	Owned	480,680	\$1,585,736.96
State Armory Westbrook	Westbrook Armory	2201-73	MIL	Owned	13,929	\$1,557,647.01
State Armory Vernon/Rockville	CTNG Vernon-Rockville	2201-71	MIL	Owned	13,999	\$1,094,918.80
470 Capitol Ave	Hartford	1326-486	DAS	Owned	31,735	\$1,026,704.86
Connecticut River Plaza	Hartford	1326-8240	DAS	Owned	914,457	\$941,034.48
Barracks - 803	CTNG Camp Nianic E Lyme	2201-206	MIL	Owned	19,191	\$916,104.98
505 Hudson St	Hartford	1326-481	DAS	Owned	155,264	\$910,134.92
GA20 Courthouse Norwalk	Norwalk	9001-20	JUD	Owned	33,000	\$865,377.58
Barracks - 802	CTNG Camp Nianic E Lyme	2201-205	MIL	Owned	19,191	\$856,293.65
Dept of Insurance	980 Main, Hartford	084-12	DAS	Leased	41,887	\$800,084.02
Administration Building - HQ	Newington	5000-4252	DOT	Owned	363,719	\$700,455.56
Office Building 55 Farmington	Hartford	1326-8239	DAS	Owned	384,808	\$590,945.95
79 Elm St	Hartford	1326-32	DAS	Owned	280,300	\$582,914.23
Southeastern Mental Health	Uncas On Thames, Norwich	1303-530	DAS	Owned	55,264	\$541,323.76
Norwich Branch	Norwich	2101-9	DMV	Owned	5,014	\$535,117.08
25 Sigourney St	Hartford	1326-480	DAS	Owned	467,000	\$516,258.89
Rowland State Government Center	55 W Main, Waterbury	1326-7101	DAS	Owned	99,691	\$424,581.50
Platt Regional Vocational Technical School	Platt RvTS, Milford	7001-16	SDE	Owned	221,320	\$420,069.50
Eli Whitney Regional Vocational Technical School	Whitney THS Hamden	7001-8	SDE	Owned	178,763	\$418,545.36
State Capitol Building	Hartford	1001-14	OLM	Owned	181,000	\$415,499.63
Norwich Regional Vocational Technical School	Norwich RVTS	7001-14	SDE	Owned	99,626	\$403,698.37
Power Plant	Rocky Hill	1312-8	DVA	Owned	29,115	\$401,584.89
DOC HQ - 24 Wolcott Hill Rd	Wethersfield	1326-6	DAS	Owned	115,000	\$377,212.45
61 Woodland Street	Hartford	1326-8532	DAS	Owned	213,421	\$372,935.27

Source: CT DEEP, 2017



Connecticut Department of Energy and Environmental Protection

State Facilities Analyses: Examples of Buildings with High Energy Costs



Source: CT DEEP, analysis of data available SFY 2017



Connecticut Department of Energy and Environmental Protection

State Facilities Analyses: Examples of Diverse Buildings with High Energy Costs

First 3 are
Power Plants

Selected Building at least 10,000 sq. ft.	Location	Agency	Sq. Ft.	Est. Annualized Cost	\$/Sq. Ft.
4400-112 : Porter Hall (Power Plant)	CT Valley Hospital, Middletown	MHA	33,722	\$1,293,904.44	\$38.37
1326-486 : 470 Capitol Ave	Hartford	DAS	31,735	\$1,026,704.86	\$32.35
7301-7777 : 0483 Cogeneration - Chiller Facility	UConn, Storrs Mansfield	UOC	31,943	\$997,447.45	\$31.23
8000-44 : H Building Gymnasium	Enfield Correctional Institution	DOC	13,312	\$321,416.79	\$24.14
7701-7 : West Campus Building	Norwalk Comm College	CSCU	51,242	\$875,784.49	\$17.09
1326-530 : Southeastern Mental Health	Uncas On Thames, Norwich	DAS	55,264	\$541,323.76	\$9.80
1326-481 : 505 Hudson St	Hartford	DAS	155,264	\$910,134.92	\$5.86
DEEP441 : Intermediate Fish Production Bldg	Quinebaug Fish Hatchery, Plainfield	DEEP	27,300	\$158,829.29	\$5.82
1326-7101 : Rowland State Government Center	55 W Main, Waterbury	DAS	99,691	\$424,581.50	\$4.26
7001-14 : Norwich Regional Vocational Technical School	Norwich	SDE	99,626	\$403,698.37	\$4.05

State agencies have a variety of different building uses



Connecticut Department of Energy and Environmental Protection

Benchmarked 27 million s.f. at 276 state buildings

CTDEEP New Britain Building
 10 Franklin Square, New Britain, CT 06050 | [Map It](#)
 Portfolio Manager Property ID: 3214300
 Year Built: 1995
[Edit](#)

ENERGY STAR Score (1-100)
 Current Score: 94
 Baseline Score: 100

Summary | Details | Energy | Water | Waste & Materials | Costs | Design

Notifications (0)
You have no new notifications.

Property Profile
You haven't created a profile for your property yet. Profiles are a way to supplement the information in Portfolio Manager with additional information about your property, including a photo.
[Create Profile](#)

Source EUI Trend (kBtu/H²)

Metrics Summary [Change Time Period](#)

Metric	Jan 2010 (Other)	Jan 2017 (Energy Current)	Change
ENERGY STAR score (1-100)	95	94	-1 (-1.1%)
Source EUI (kBtu/H ²)	105.7	110.7	4.26 (3.9%)
Site EUI (kBtu/H ²)	24.6	26.5	1.95 (7.9%)
Energy Cost (\$)	122,086.44	121,048.79	-2,104.46 (-1.72%)
Total GHG Emissions (MMBtu/Year CO2e)	177.4	187.2	9.86 (5.5%)
Water Use (All Water Sources) (Agal)	Not Available	Not Available	N/A
Total Waste (Disposal and On-site) (Tons)	Not Available	Not Available	N/A

Check for Possible Data Errors
Run a check for any 12-month time period to see if there are any possible errors found with your data.
[Check for Possible Errors](#)



Connecticut Department of Energy and Environmental Protection

Lead by Example Results



Established master agreements with Connecticut's utilities to unlock the ability of state agencies to use utility administered programs to complete small-scale energy efficiency investments in facilities.



Continued to install medium-scale energy equipment retrofits in state facilities using general obligation bond funded allocations.

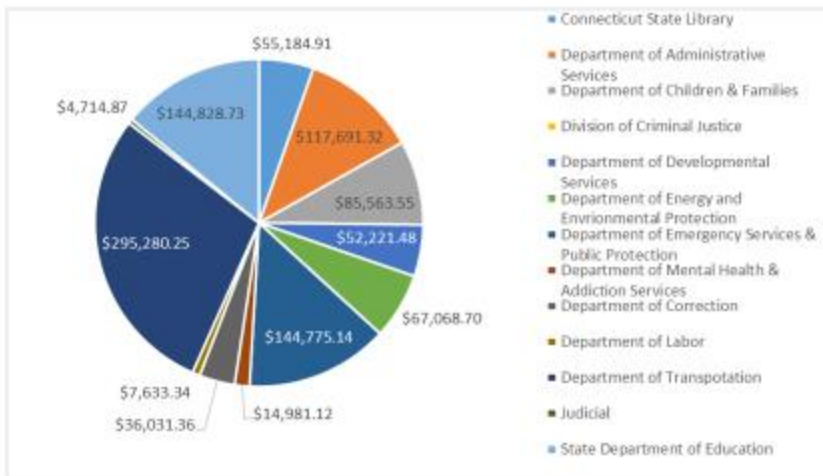


Initiated a standardized guaranteed Energy Savings Performance Contracting Program to plan for and implement large-scale, comprehensive projects with multiple energy savings measures at state facilities.



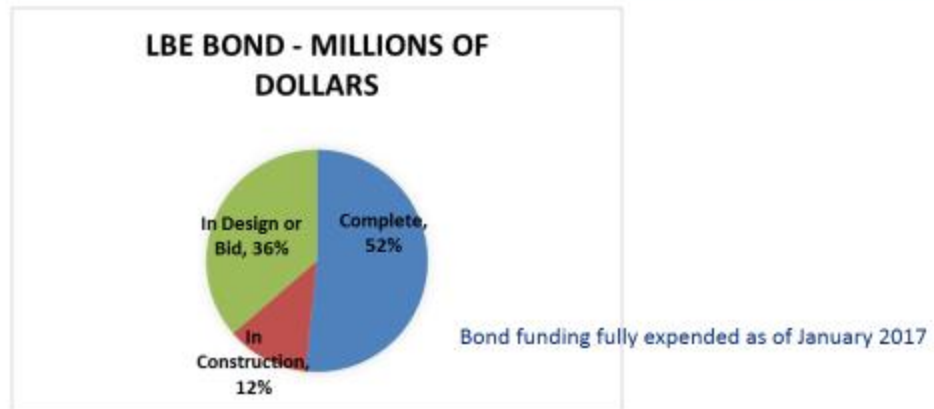
Connecticut Department of Energy and Environmental Protection

Small-Scale Projects Savings 2014-2017



Connecticut Department of Energy and Environmental Protection

Medium-Scale Projects 2012-2017

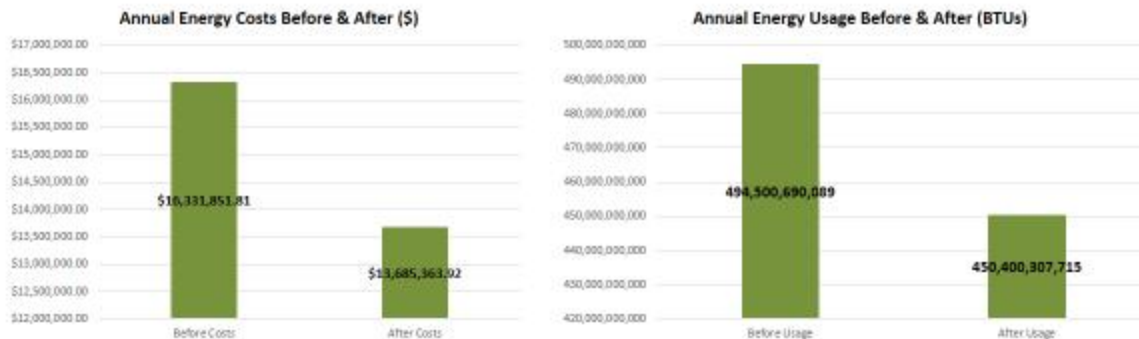


72 Projects approved, resulting in estimated 89.3 billion BTUs reduced and \$2.91M savings annually. Average 5.9 year payback.



Connecticut Department of Energy and Environmental Protection

Energy Reduction from 44 Upgrades 2012-2017



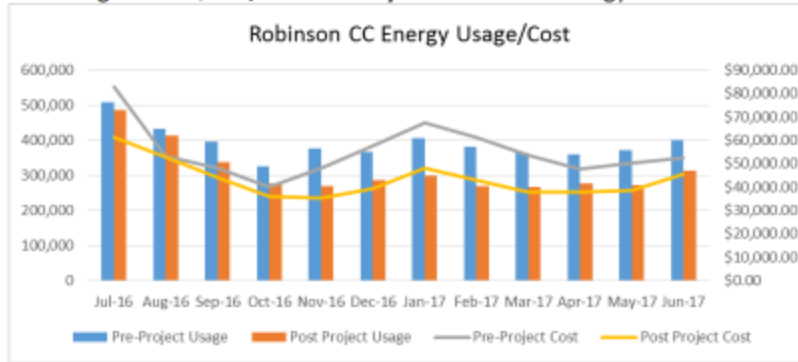
Out of the 60 projects completed, 44 projects have a years' worth of data to see what type of savings there was. Figure X shows the before and after energy cost and usage in BTUs for the 44 projects. These projects have saved \$2.6 million, 31.5 billion BTUs, and reduced GHG emissions by about 71K tons to date.



Connecticut Department of Energy and Environmental Protection

Example of completed upgrade: CT DOC, Robinson Correctional Center

- Department of Correction replaced inefficient, outdated rooftop HVAC units
- The project cost was \$275,381.09
- In the first year after installation, the upgrade saved over **3000 MMBTU**.
- The upgrade is saving almost **\$143,000 annually** from avoided energy costs.



Connecticut Department of Energy and Environmental Protection

Example: Energy Savings as Financing = Jobs

[CT Valley Hospital, ESPC project webpage](#)



Site Issues

CT Department of Health & Human Services, Connecticut Valley Hospital
 CT Department of Energy & Environmental Protection, Facilities Division
 CT Department of Transportation

Owner
 Connecticut Valley Hospital

WBCT is a part of CT Green, Connecticut's leader in Green Buildings.
 Connecticut's leading provider in the design and building space solutions industry.
 For more information, visit [www.wbct.com](#)

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\$31.9M in guaranteed energy and maintenance savings

35% reduction in energy use

Reduced GHG emissions of estimated 10,000 metric tons of CO₂

2 miles of new steam and condensate pipes

1.5 megawatt Cogen System

Solar-Powered electric vehicle charging station



Connecticut Department of Energy and Environmental Protection

CVH ESPC Savings during Construction Phase

Energy Conservation Measures	Estimated Energy Savings Annually (\$)	Estimated Energy Savings Annually (mmBtu)	Construction Percent Complete	Estimated Energy Savings To Date (\$)	Estimated Energy Savings To Date (mmBtu)
Interior Lighting Upgrades	\$20,982	1,353	42%	\$25,904	448
Exterior & Street Lighting Upgrades	\$35,015	234	42%	\$4,290	102
Lighting Controls	\$21,433	143	42%	\$2,608	62
Steam Distribution Upgrades	\$332,531	4,713	11%	90	-
15 Megawatt Cogeneration Systems	\$690,307	1180	15%	90	-
Energy Management Systems Upgrades & Retro-Commissioning	\$140,119	1,585	15%	90	-
New Energy Efficient Chillers	\$48,815	333	81%	90	-
New Windows	\$120,507	1,588	2%	\$1,205	186
Energy Efficient Transformers	\$1,782	12	22%	\$294	7
Pipe & Mechanical Equipment Insulation	\$60,688	860	98%	\$28,018	4871
Steam Trap Repair & Replacements	\$77,516	1,099	63%	\$5,814	1012
Pool Upgrades**	\$2,520	23	5%	90	-
Fuel Switching	\$31,340	164	7%	90	-
Electric Vehicle Solar Carport Charging Station	90	0	11%	90	-
New 800HP Power Plant Boilers	\$65,555	893	23%	90	-
TOTAL PROJECT SAVINGS TO DATE*				\$68,102	6,688 mmBtu



Connecticut Department of Energy and Environmental Protection

Competitive Purchase of Aggregated Electricity Supply

Procurement conducted through RFP process in 2017 resulted in a contract from July 2017 through June 30, 2018. Contract extended through SFY19.

- **The rate for state agencies: The price is 7.533 cents per kWh.**
 - That pricing is better than the Standard Service pricing through December 2017, which for Eversource is 8.01 cents, and for UI is 7.60 cents.
 - Similar competitive pricing achieved through contract extension for SFY19
- **Effective dates for that price: July 2017 through June 30, 2018.**
- **The percent of Class 1 Renewable 16.31% [15.5% in 2017 and 17% in 2018].**
- **The supplier is Direct Energy Business, LLC.**

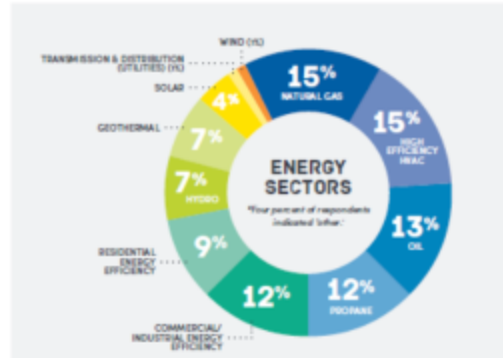


Connecticut Department of Energy and Environmental Protection

Workforce Focus: 2017 CBIA-DEEP Survey of Workforce Needs

- DEEP continues to support Connecticut's energy workforce development
- DEEP commissioned a Survey of Energy and Energy Efficiency Workforce Needs
 - Funded by a U.S. Department of Energy grant
 - Conducted by CBIA Education & Workforce Partnership

Respondents represent variety of industry sectors



Connecticut Department of Energy and Environmental Protection

Tunxis Community College stackable certificates and A.A.S. Degree



The A.A.S. Degree in Energy Management

The Applied Associate of Science Degree in Energy Management is a unique two-year technical training program that prepares you for a rewarding career in commercial building energy analysis and energy management.

Students evaluate energy use patterns, develop, implement, monitor and maintain conservation programs, perform audits, analyze commercial energy efficiency techniques, integrate alternative energy sources, and perform systems analysis to solve problems.

You will apply basic physics and analytical techniques to measure and define energy use of today's building systems with the goal of evaluating and recommending alternative energy solutions that will result in greater energy efficiency and lower energy costs. Students need no prior experience to enroll in the program.

Climate change, and our need to reduce energy consumption in buildings, has created new job and career opportunities for energy professionals.

<https://www.tunxis.edu/completion/energy-management>



Connecticut Department of Energy and Environmental Protection

Preparing for the future



Energy Management Degrees + Certificates

Certificate in HVAC Energy Analysis

Heating, Ventilation and Air Conditioning (HVAC) systems are among the biggest energy users in commercial buildings. The HVAC Energy Analysis certificate focuses on HVAC and introduces students to commercial HVAC equipment, how these systems work, how they are controlled, how to operate them more efficiently, and what system improvements can be made to increase overall performance and energy savings. Students learn to identify commercial HVAC system types and the energy impact of each. Calculations are used to determine HVAC system efficiency.

Certificate in Energy Core

Energy Core provides students with practical courses needed to advance into any of the other five energy certificates, and/or the AAS Degree in Energy Management. Energy Core courses are offered multiple times at various CT Community Colleges each year.

Energy Management

The Applied Associate of Science Degree in Energy Management is a unique two-year technical training program that prepares you for a rewarding career in commercial building energy analysis and energy management.

SEE HELP

<https://www.tunxis.edu/completion/energy-management>



Connecticut Department of Energy and Environmental Protection

Looking Ahead

- **DEEP received authorization of \$20 million in General Obligation (GO) Bonds in the new budget that was passed in the fall of 2017 for energy management upgrades**
- DEEP, in collaboration with the CT Dept. of Administrative Services, the Attorney General's Office, other agencies, and the CT Green Bank, has been developing standardized documents to allow the Executive Branch State Agencies to install renewable energy at their facilities.
- The Connecticut State Colleges and Universities have been installing solar PV systems at various Community Colleges and State Universities

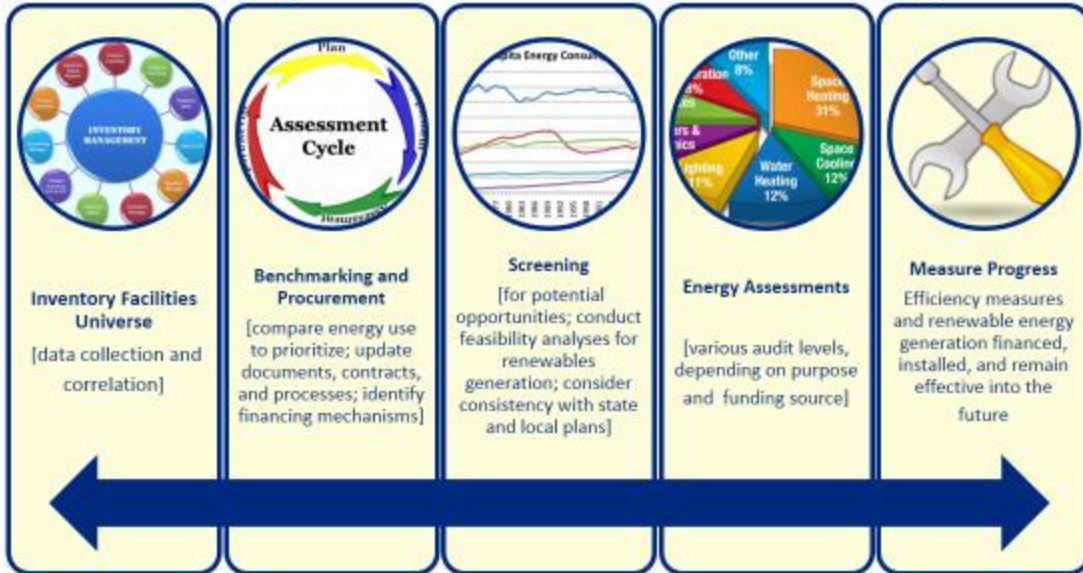


Manchester Community College, Manchester, CT



Connecticut Department of Energy and Environmental Protection

Strategic Plan for Better State Buildings



Thank you!

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Bureau of Energy and Technology Policy



Connecticut Department of Energy and Environmental Protection