



Connecticut Department of Energy and Environmental Protection



Leading By Example Update: Improving Energy Management at Connecticut State Facilities

Office of Energy Demand
Bureau of Energy and Technology Policy

May 31, 2018



Connecticut Department of Energy and Environmental Protection

2017 Highlights



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



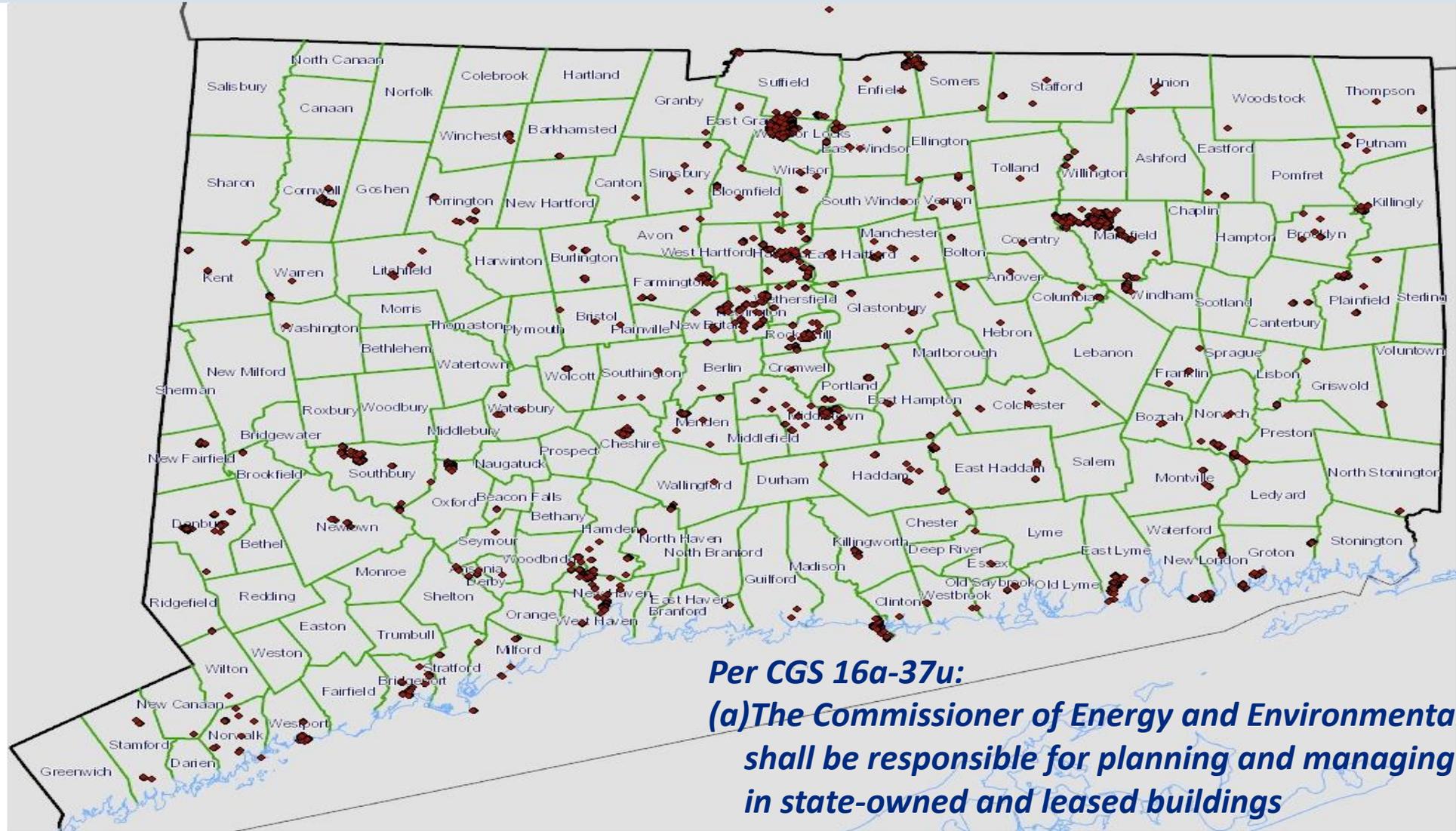
Purchased competitive electricity supply for all agencies at pricing below standard offer



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



Many State Facilities = Many Opportunities to Improve Energy Use



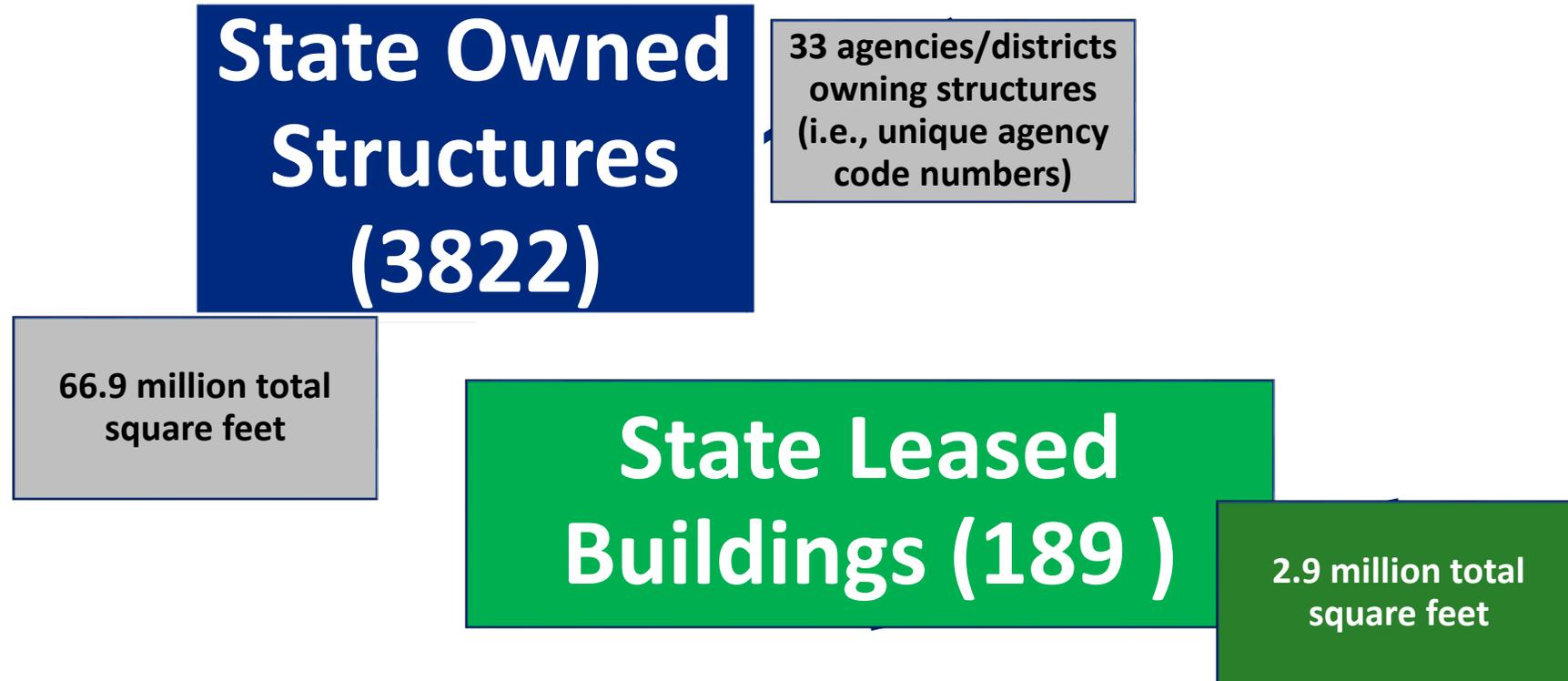
Per CGS 16a-37u:

(a)The Commissioner of Energy and Environmental Protection shall be responsible for planning and managing energy use in state-owned and leased buildings



Connecticut Department of Energy and Environmental Protection

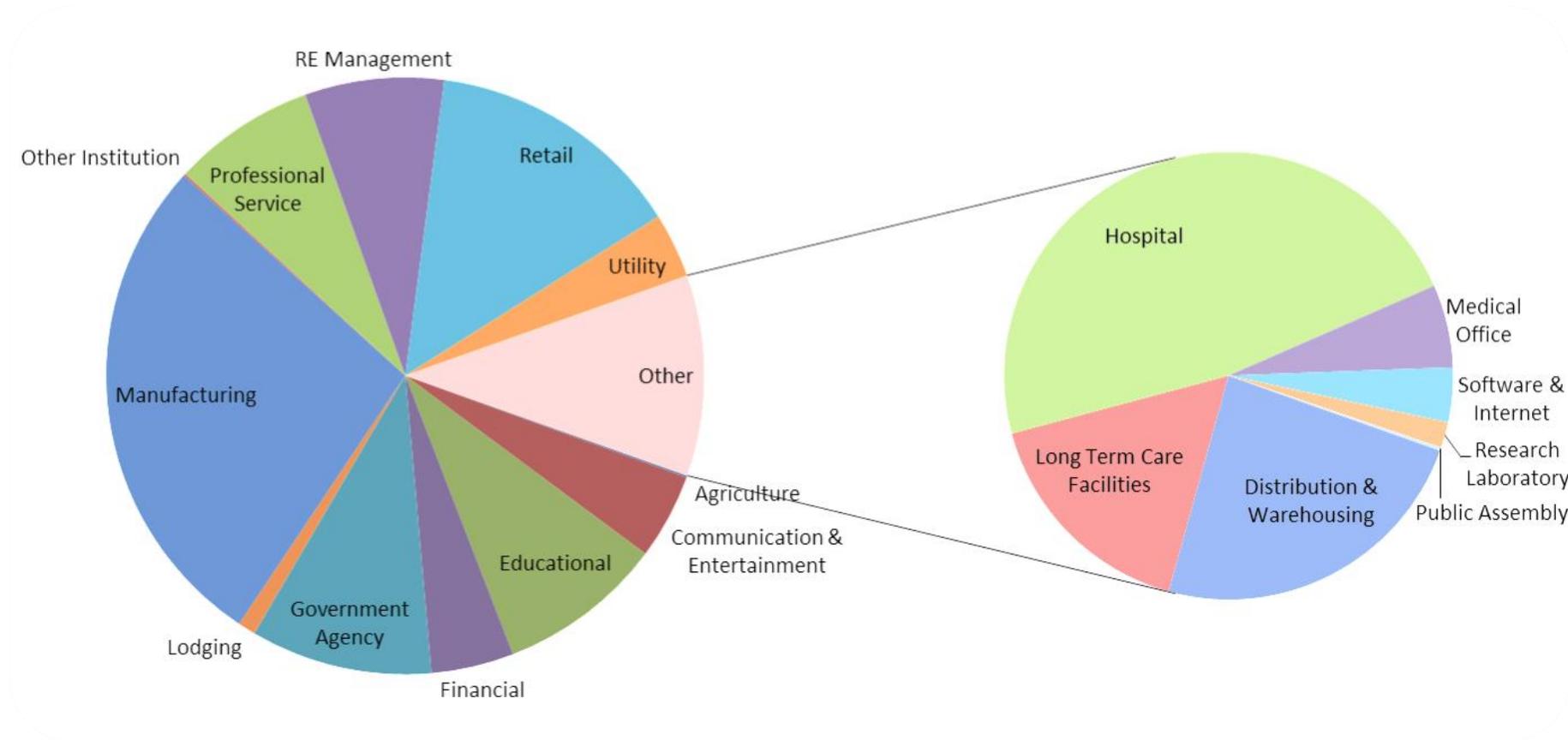
~70 million square feet of state structures



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



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



Source: Eversource Data and Graphic, 2015



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.

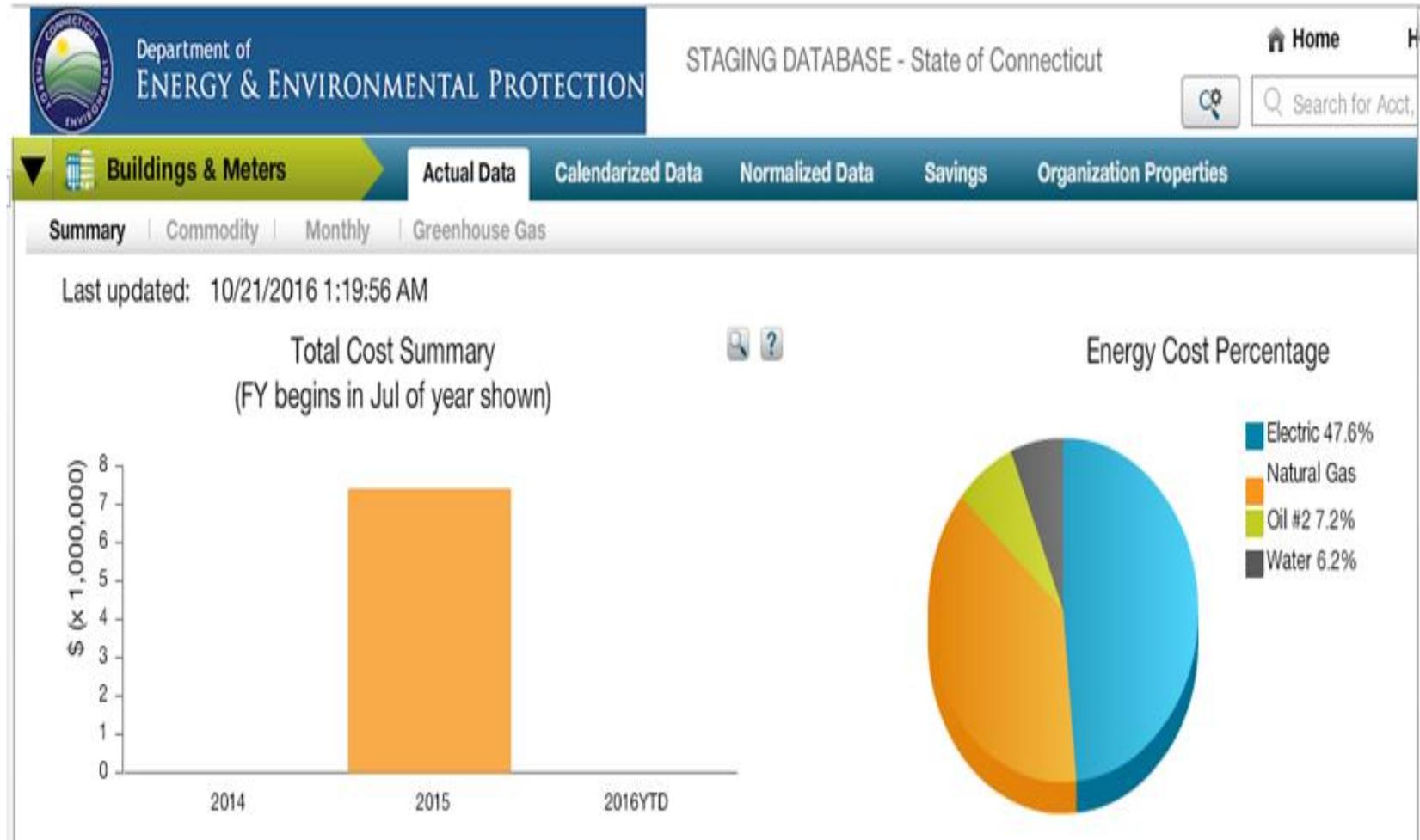
Ensures the ability to measure energy savings.

Can identify savings opportunities related to energy billing.

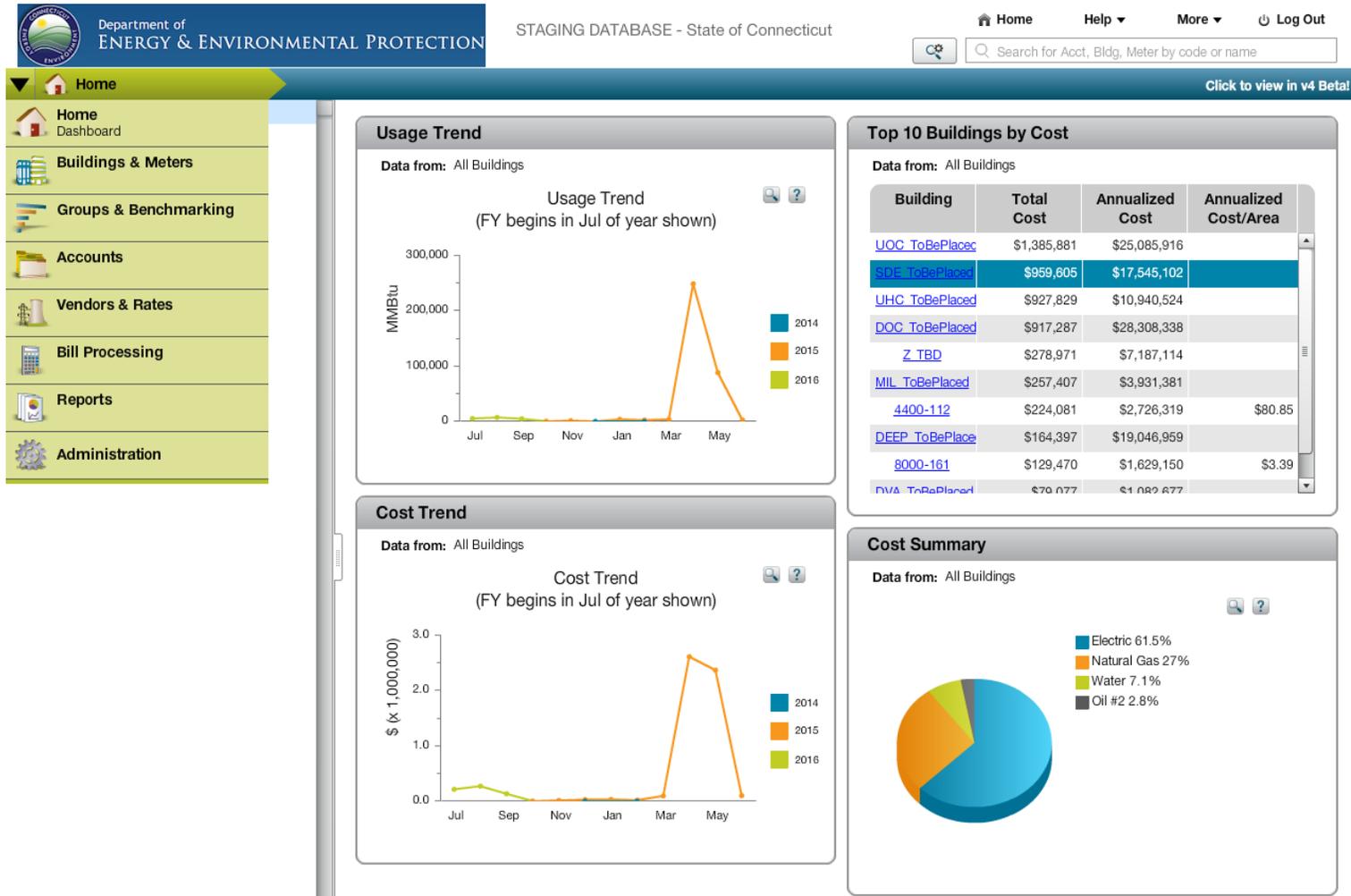
CT DEEP plans and implements actions to improve energy management in state buildings consistent with CGS 16a-35k and 22a-1a, pursuant to CGS 16a-6, CGS 16a-37t, 16a-37u, 16a-37x, 16a-38a, 16a-38b, 16a-38i, 16a-38l, and 16a-39b.



Agency Analyses



Analyze Usage Trends by Agency and Building



Analyze Cost Trends by Agency and Building

Department of ENERGY & ENVIRONMENTAL PROTECTION

STAGING DATABASE - State of Connecticut

Home Help More Log Out

Search for Acct, Bldg, Meter by code or name

Buildings & Meters Actual Data Calendarized Data Normalized Data Savings Organization Properties Click to view in v4 Beta!

Buildings

- AES [Ag Experiment Station]
- BOR [Board of Regents for Higher Ed]
- BRS [Rehabilitation Services, Dept. of]
- CSL [CT State Library]
- DAG [Agriculture, Dept. of]
- DAS [Administrative Services, Dept. of]
- DCF [Children & Families, Dept. of]
- DCJ [Criminal Justice, Div. of]
- DDS [Developmental Services, Dept. of]
- DEEP [Energy & Env. Protection, Dept. of]
- DMV [Motor Vehicles, Dept. of]
- DOC [Correction, Dept. of]**
 - 8000-183 [Webster Correctional]
 - 8000-241 [CommunityEnforcement/VNA]
 - 8000-495 [Northern Correctional Institution]
 - DOC-ELE049 [BILTON RD - ELE01]
 - DOC-NG029 [287 BILTON RD - NAT01]
 - BRIDGEPORTCC [Bridgeport CC]
 - 8000-242 [Madison Unit]
 - DOC-ELE078 [1106 NORTH AVE - ELE01]
 - 8000-243 [New Center]
 - 8000-244 [Memorial Unit]
 - 8000-7101 [Fairmont Unit]
 - BROOKLYNCI [Brooklyn CI]
 - CHESHIRECI [Cheshire CI]
 - CORRIGANRADGOWSKICI [Corrigan-Radgowski CI]
 - DOC_ToBePlaced [DOC_To Be Placed]
 - ENFIELDCI [Enfield CI]
 - GARNERCI [Garner CI]
 - GATESCI [Gates CI]
 - HARTFORDCC [Hartford CC]
 - LITCHFIELDCC [Litchfield Correctional Center]
 - MACDOUGALLWALKERCI [MacDougall-Walker CI]
 - MALONEYCI [Maloney CI]
 - MANSONYCI [Manson YCI]

Summary Commodity Monthly Greenhouse Gas

Last updated: 12/01/2016 1:19:13 AM

Total Cost Summary (FY begins in Jul of year shown)

Energy Cost Percentage

- Electric 51.8%
- Water 25.2%
- Natural Gas
- Oil #2 2.9%
- Gasoline 1%

Daily Average Cost

Percentage Change from Previous Year To Current Year

N/A

Current Year: Nov 2015 - Oct 2016 \$3,442.28

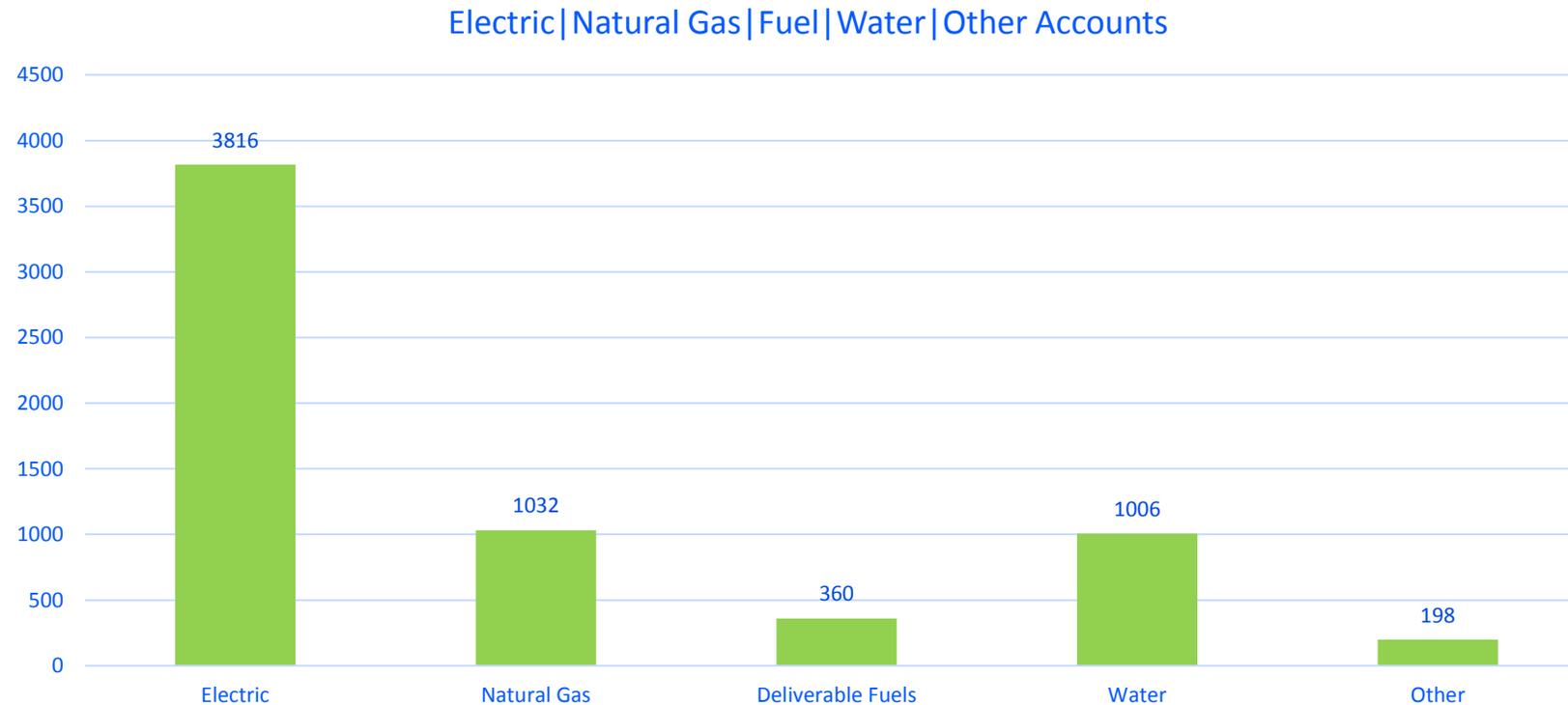
Previous Year: Nov 2014 - Oct 2015 \$

Note that DOC is organized by facility, buildings within facilities, and accounts associated with the buildings.

The graphs depict DOC cost breakdown of currently entered data, which is not yet complete.



State Energy Accounts by Commodity*



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

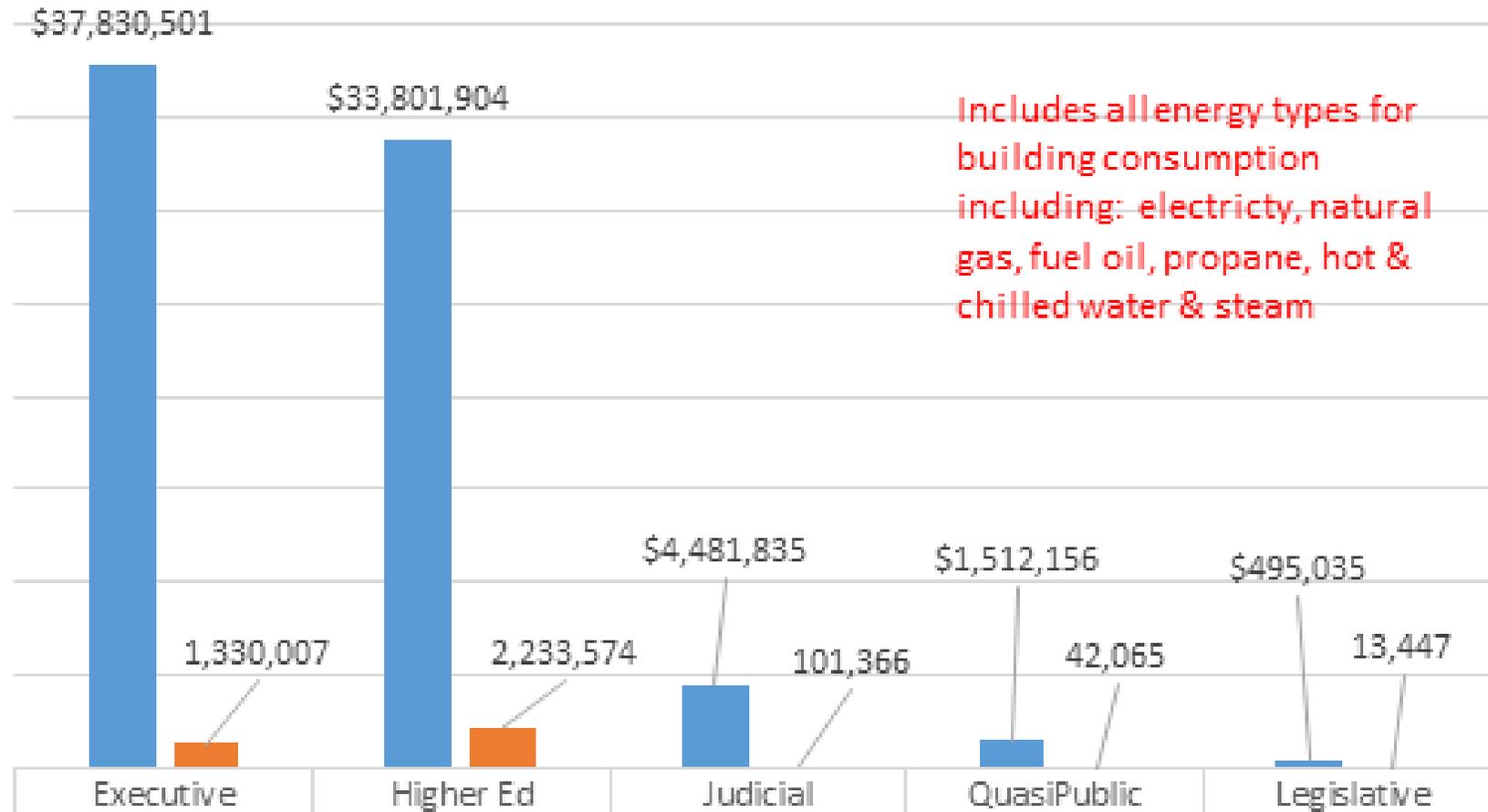
**Based on Best Estimates from CT DEEP data from state fiscal year 2017; data not complete*



Connecticut Department of Energy and Environmental Protection

State Agencies' Annual Energy Consumption and Spending

FY17 State Est. Energy Cost & Use (MMBtu)



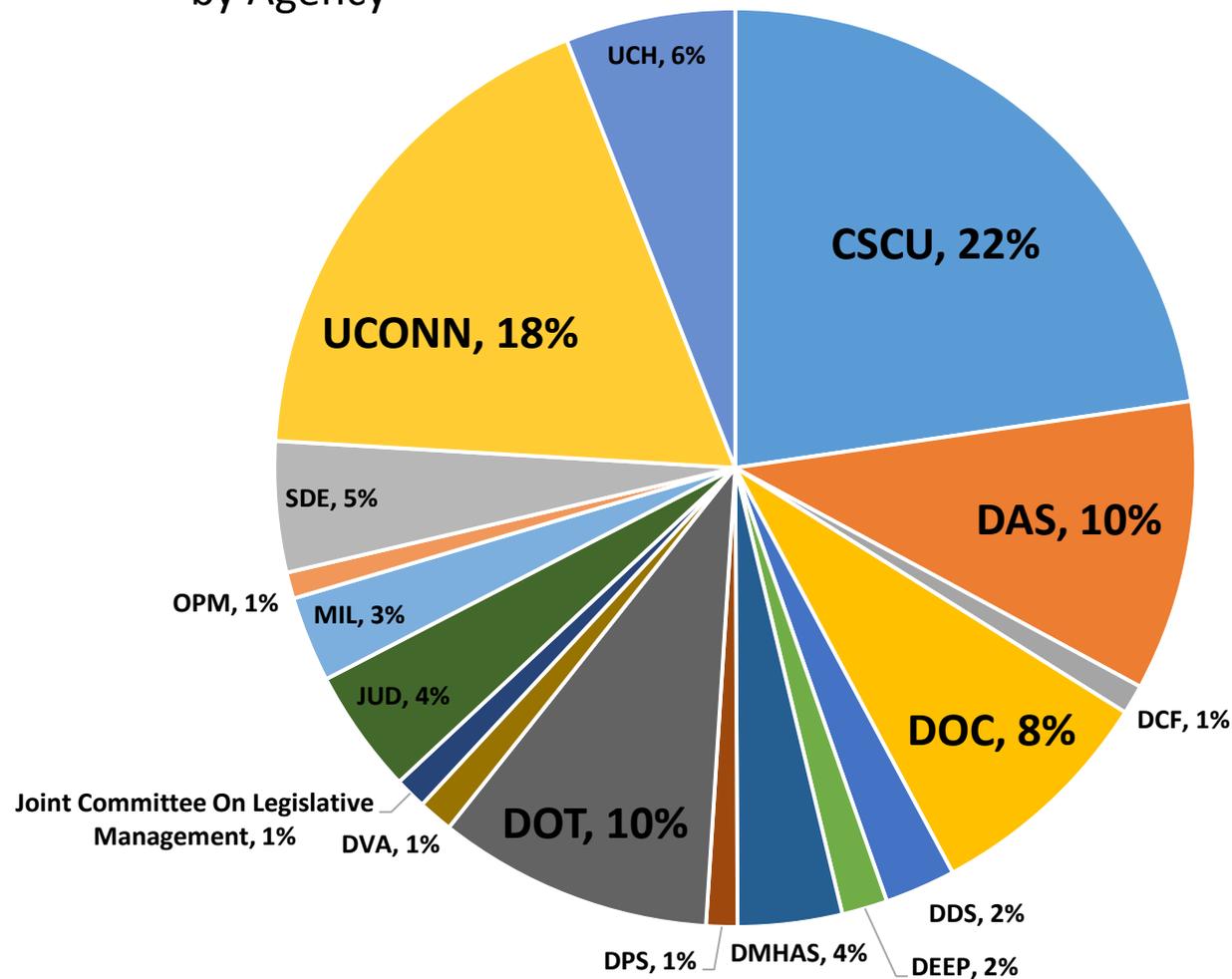
■ Total \$	\$37,830,501	\$33,801,904	\$4,481,835	\$1,512,156	\$495,035
■ Total MMBTU	1,330,007	2,233,574	101,366	42,065	13,447



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



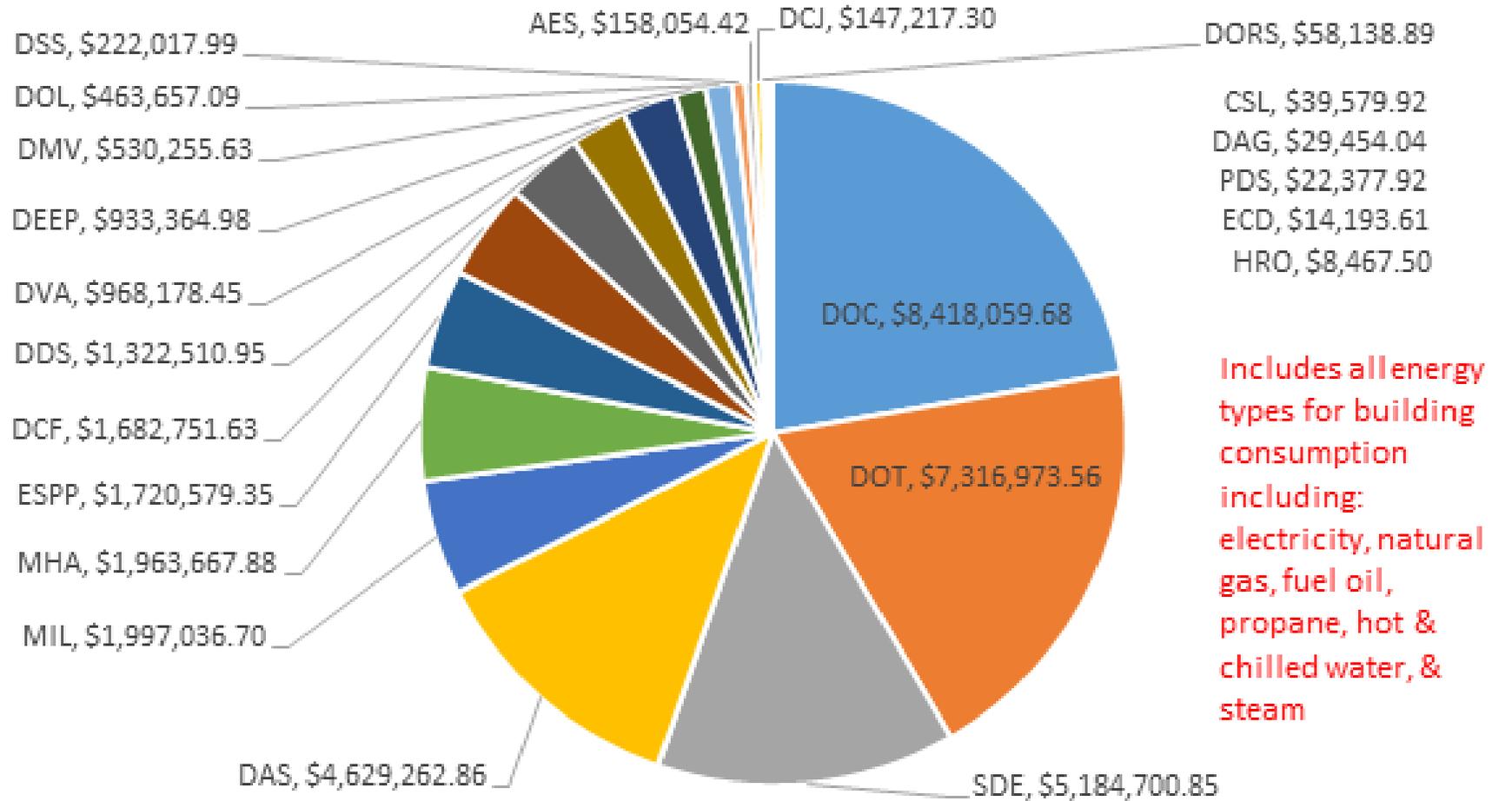
Source: CT Office of Policy and Management, JESTIR database 2017



Connecticut'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

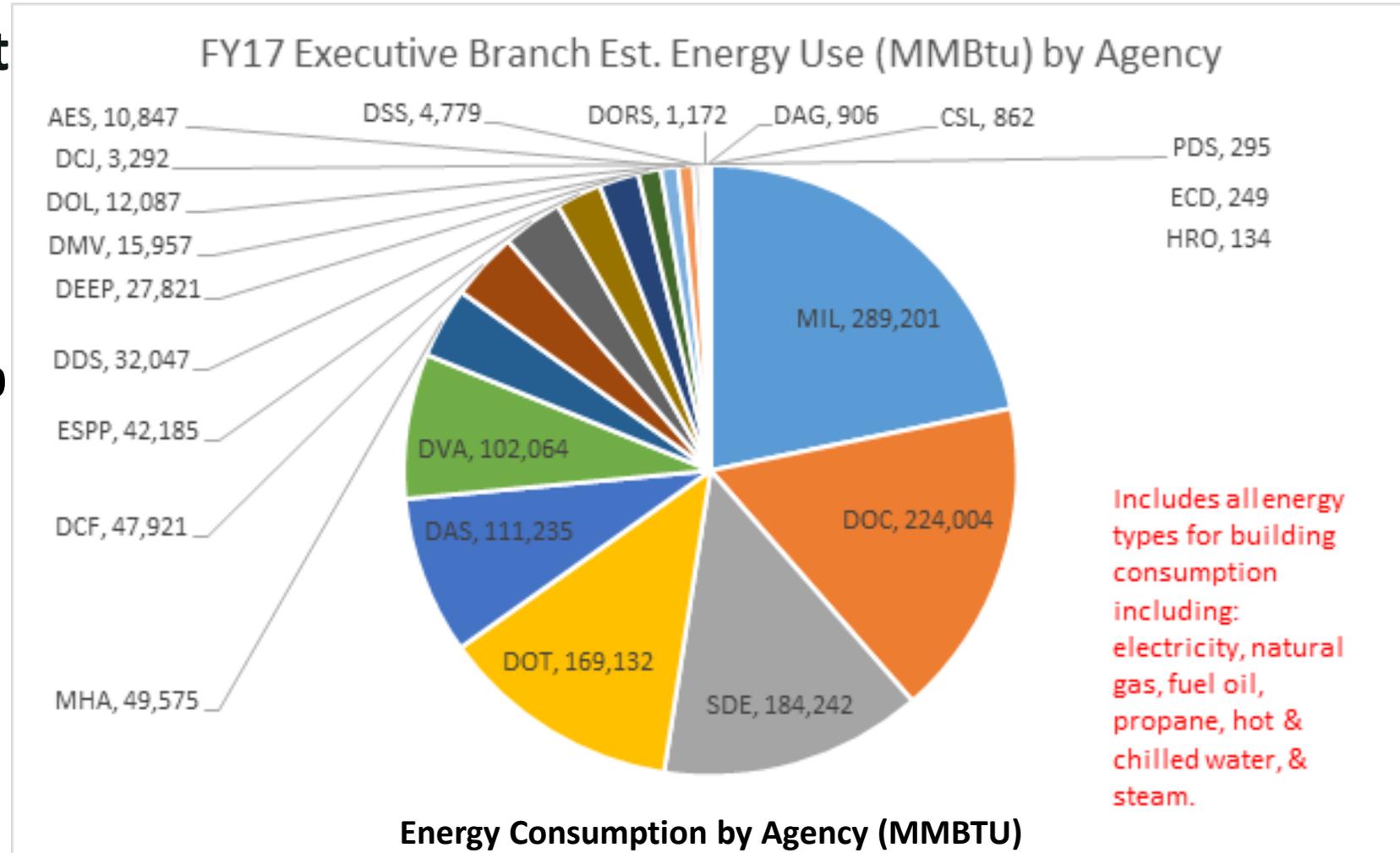


Connecticut's Energy Consumption by Agency (MMBTU)

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

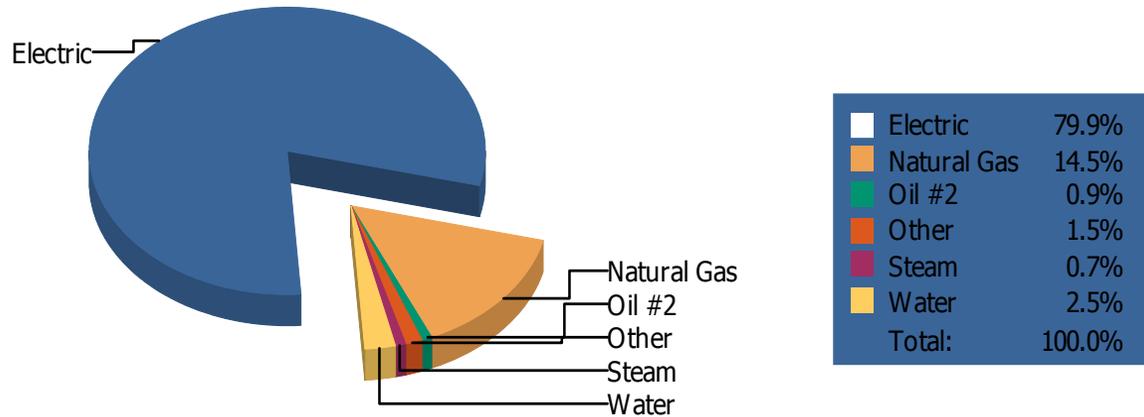
- There are **243** state owned or leased buildings **of at least 10,000 sq.ft.** These are located in the following agencies:

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

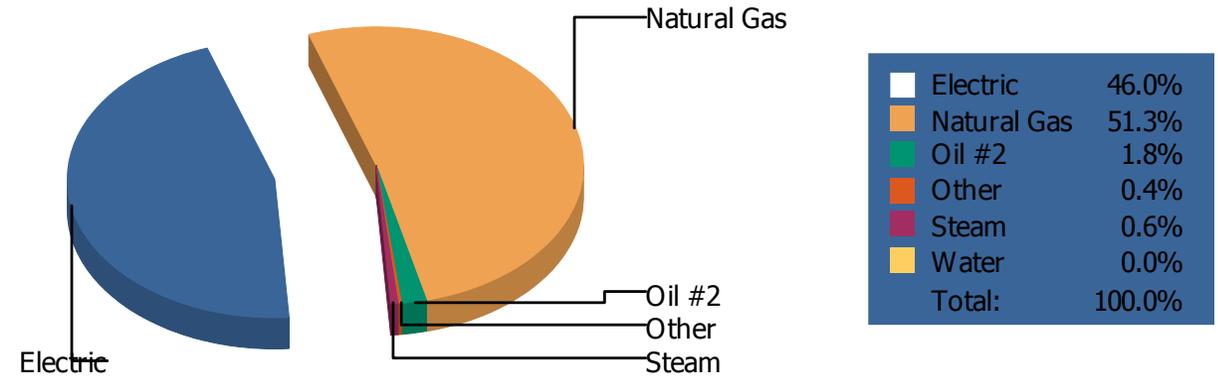


State Agencies' Total SFY17 Percentage of Energy Cost & Consumption*

Cost Percentage



Use Percentage



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



State Facilities Analyses: Examples of Buildings with High Energy Costs

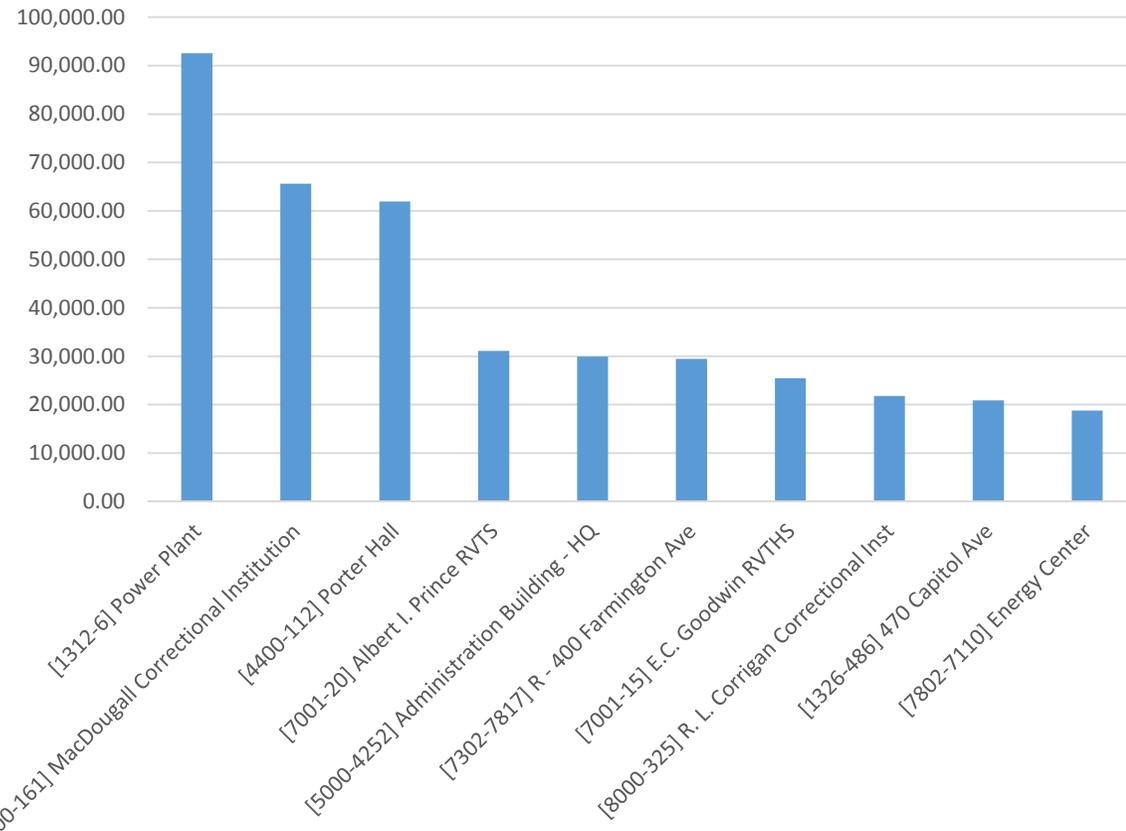
Top 25 Buildings by Estimated Annualized Cost (less Higher Education)						
Building Name	Location	ID	Agency		Sq. Ft.	Est. Annualized Cost
Hangar - TASMG	CTNG - TASMG Groton	2201-46	MIL	Owned	126,841	\$3,231,078.89
MacDougall Correctional Institution	MacDougall CI, Suffield	8000-161	DOC	Owned	480,680	\$1,565,736.96
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	960 Main, Hartford	064-12	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	1312-6	DVA	Owned	29,115	\$401,584.69
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

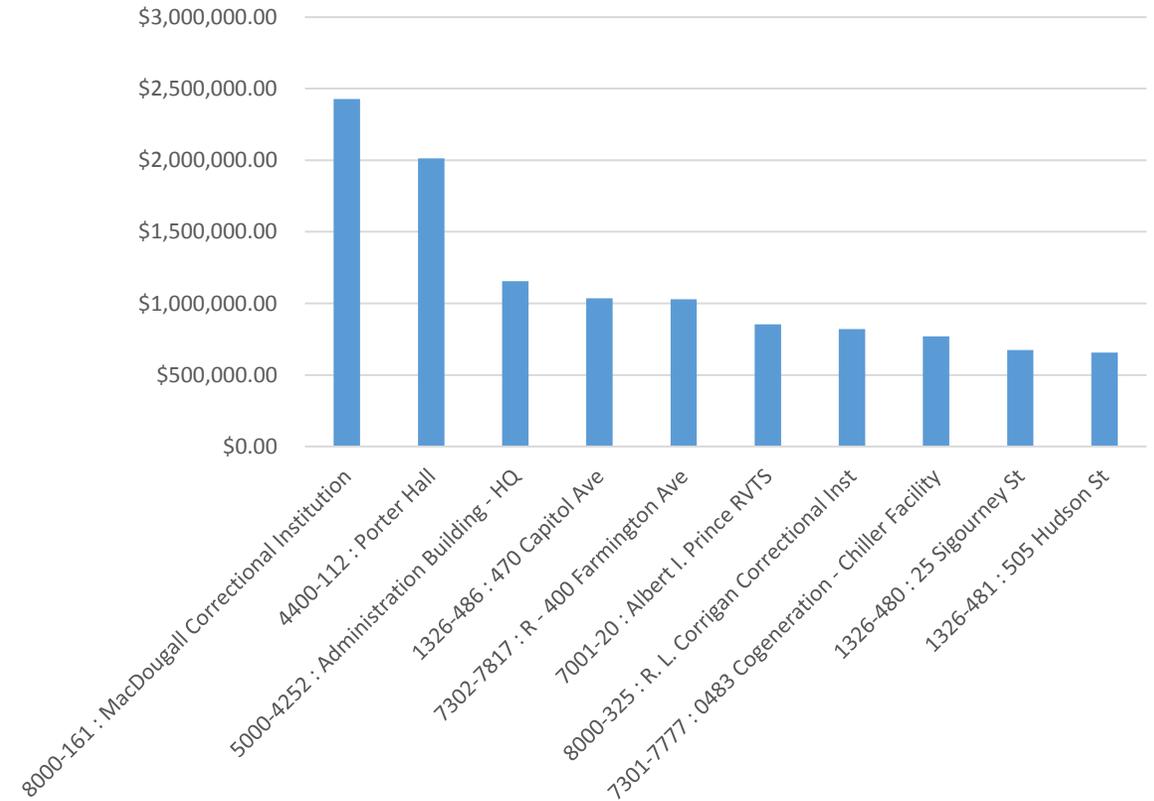


State Facilities Analyses: Examples of Buildings with High Energy Costs

Buildings Ranked by Consumption Per Area



Buildings Ranked by Cost Per Area



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

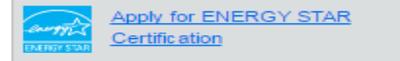
CTDEEP New Britain Building

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

Goals

Design

Notifications (0)

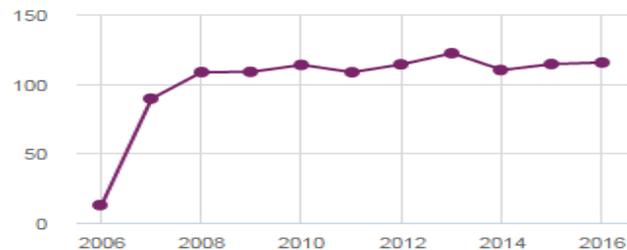
You have no new notifications.

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/ft²)



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/ft ²)	108.7	114.7	6.0(5.5%)
Site EUI (kBtu/ft ²)	34.6	36.5	1.9(5.5%)
Energy Cost (\$)	122,054.44	101,049.79	-21004.65(-17.2%)
Total GHG Emissions (Metric Tons CO ₂ e)	177.4	187.2	9.8(5.5%)
Water Use (All Water Sources) (kgal)	Not Available	Not Available	N/A
Total Waste (Disposed and Diverted) (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](#)



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.



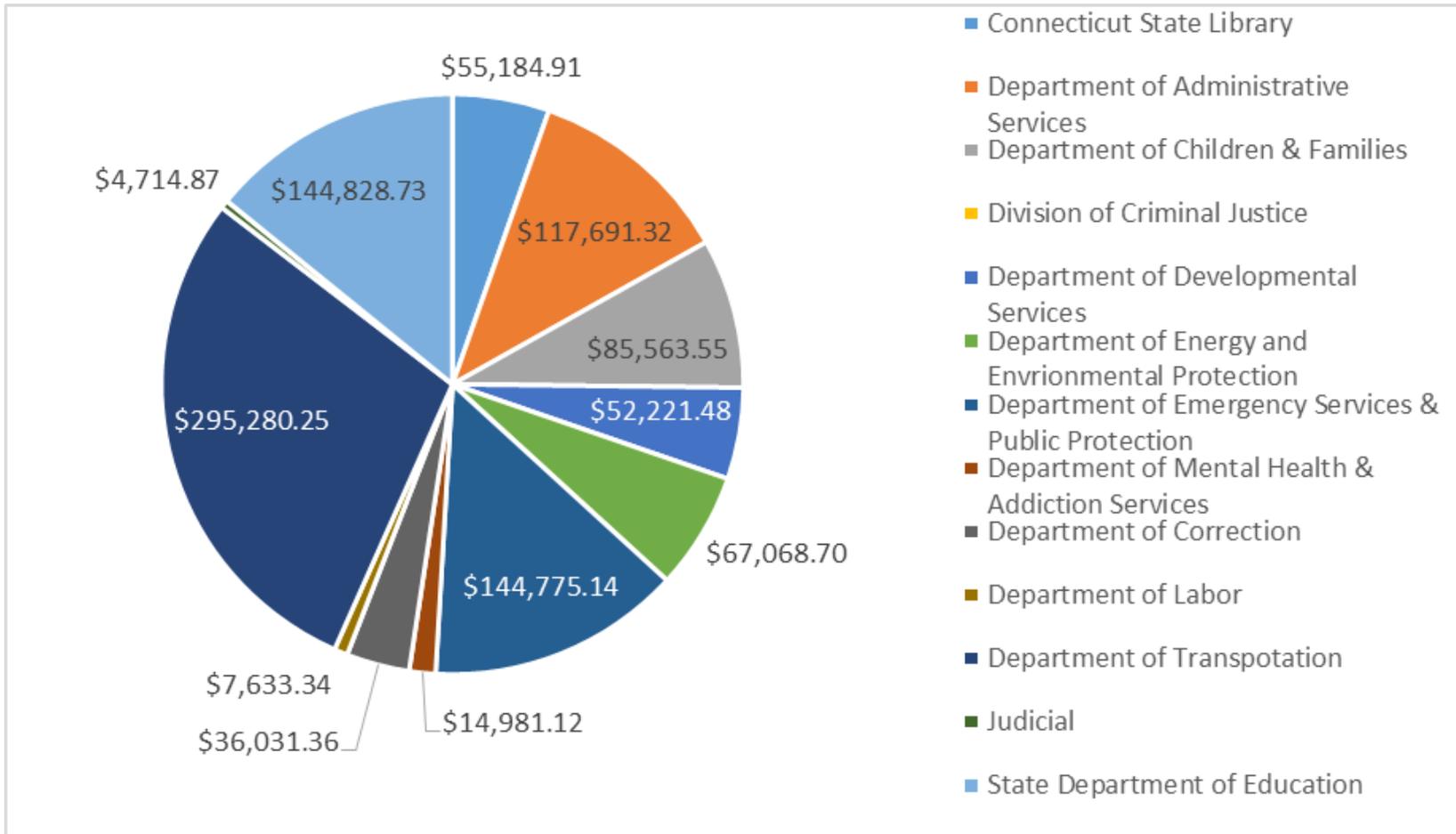
Continued to install medium-scale energy equipment retrofits in state facilities using general obligation bond funded allocations.



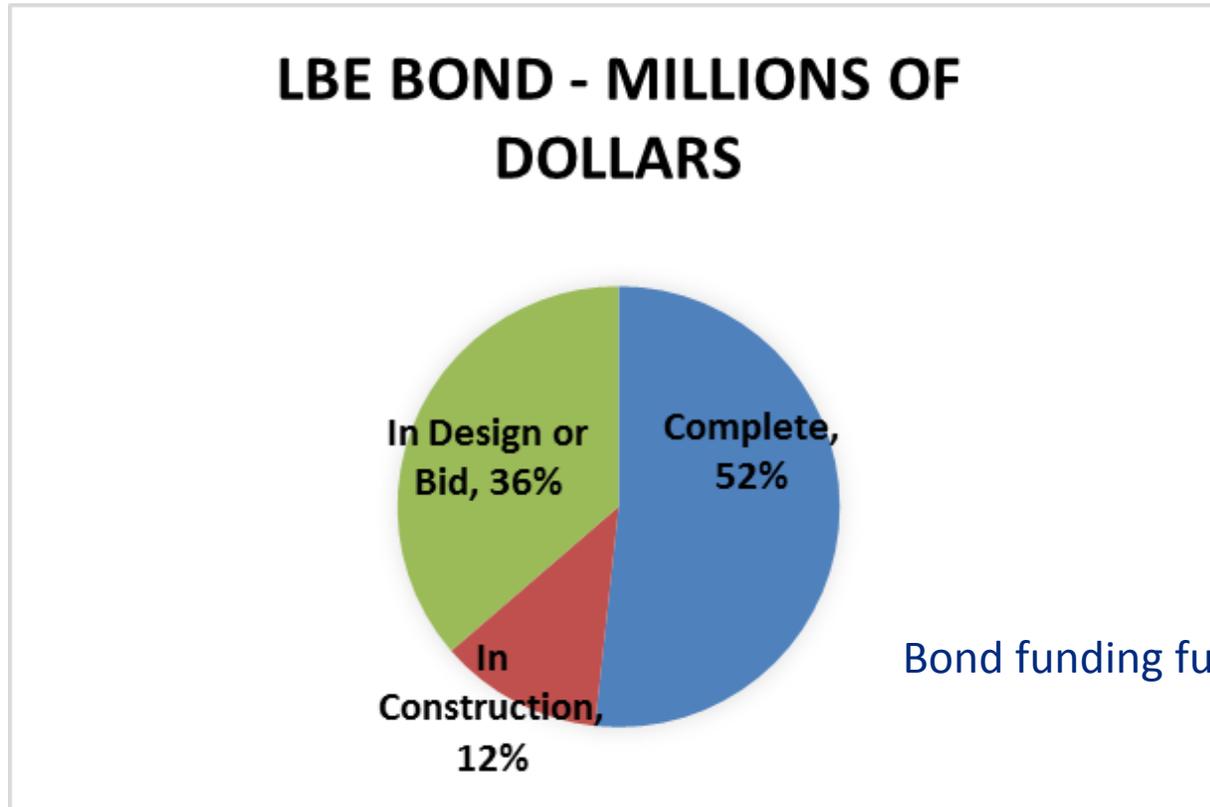
Initiated a standardized guaranteed Energy Savings Performance Contracting Program to plan for and implement large-scale, comprehensive projects with multiple energy savings measures at state facilities.



Small-Scale Projects Savings 2014-2017



Medium-Scale Projects 2012-2017

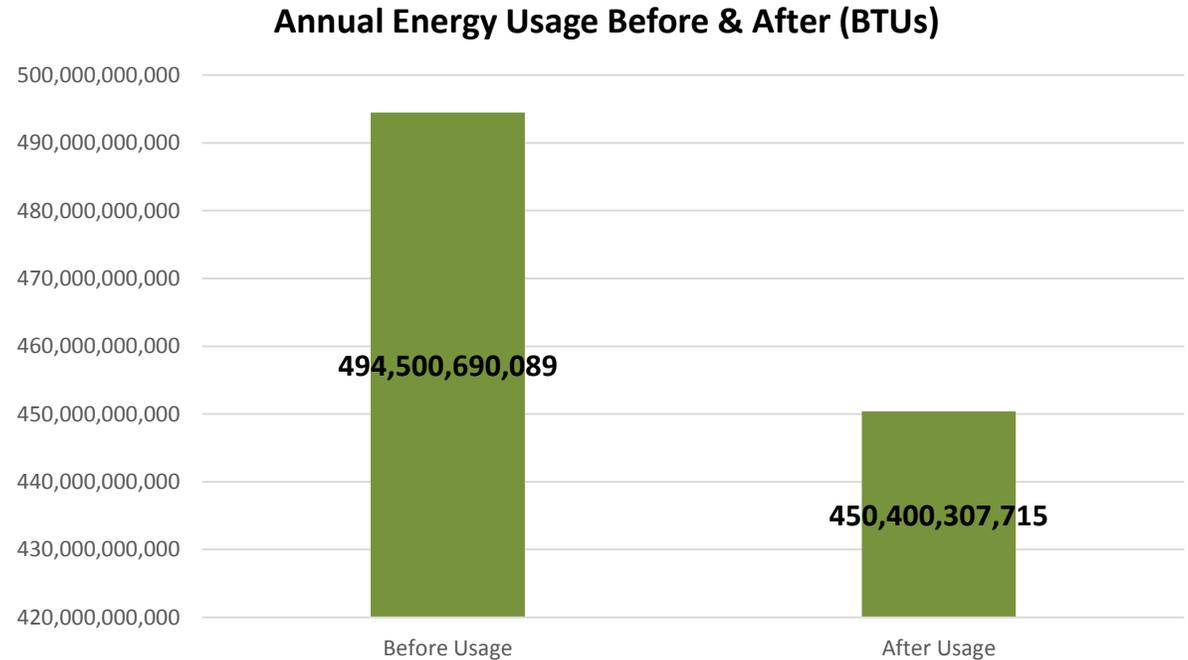
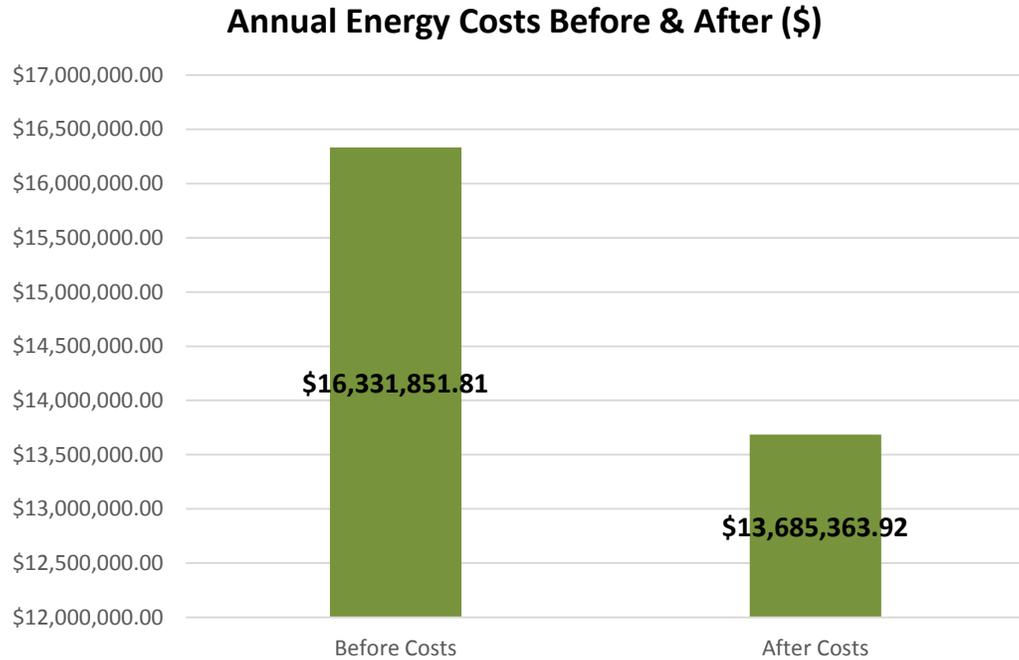


Bond funding fully expended as of January 2017

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



Energy Reduction from 44 Upgrades 2012-2017

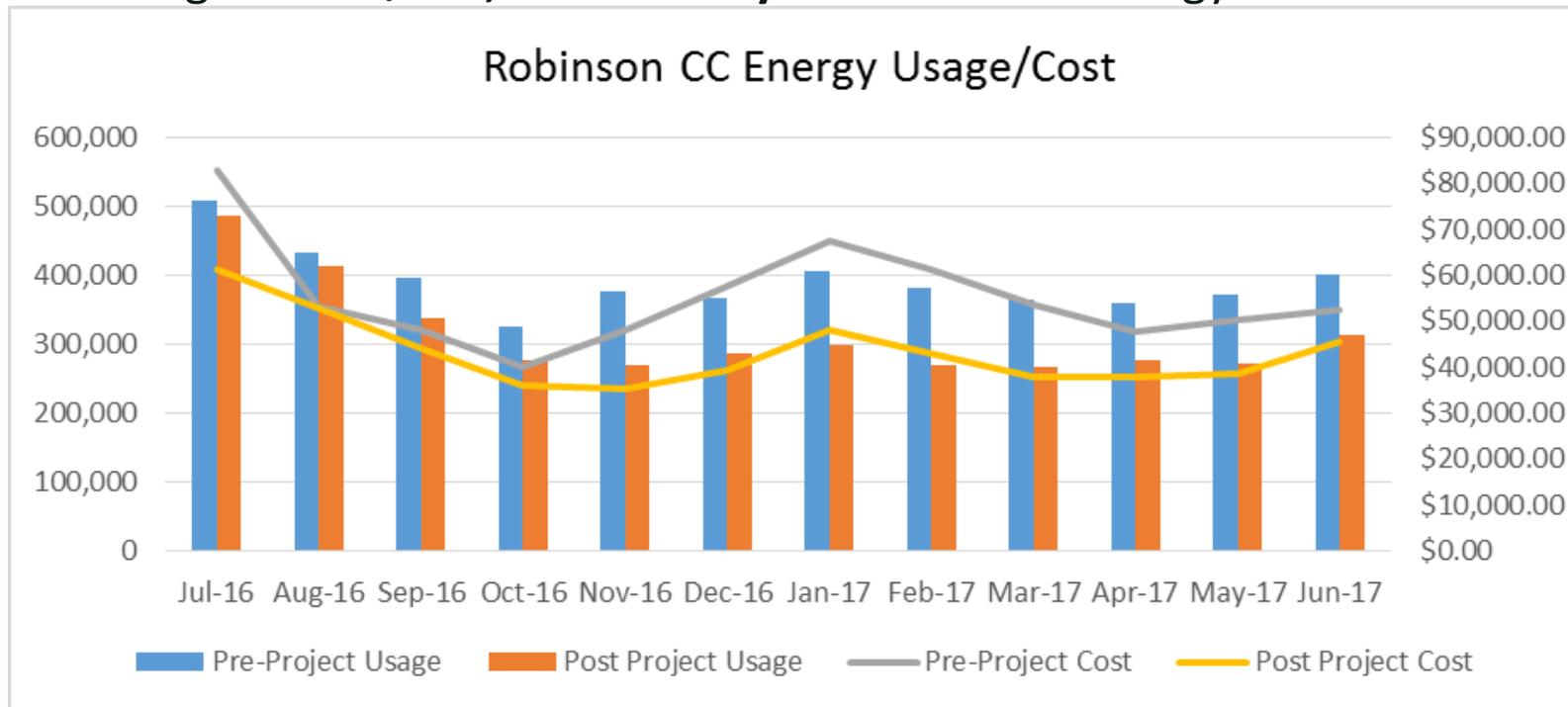


Out of the 60 projects completed, 44 projects have a years' worth of data to see what type of savings there was. Figure X shows the before and after energy cost and usage in BTUs for the 44 projects. These projects have saved \$2.6 million, 31.5 billion BTUs, and reduced GHG emissions by about 71K tons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



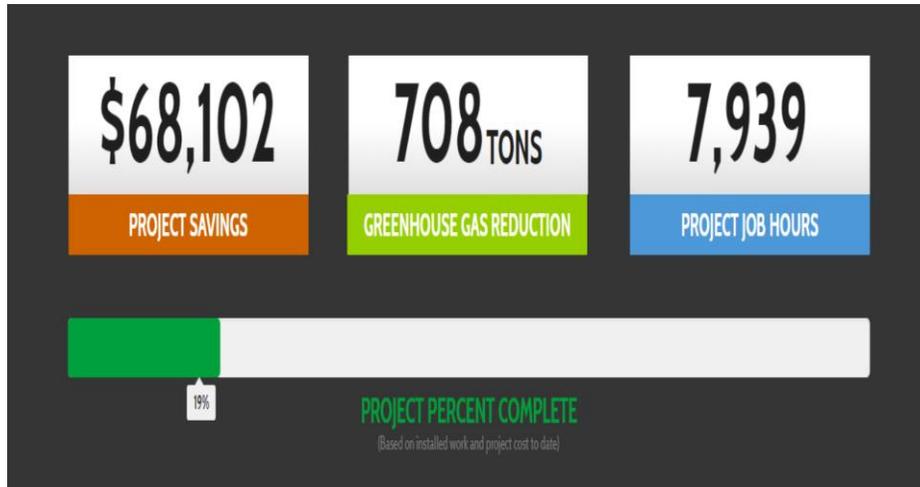
Example of completed upgrade: CT DOC, Robinson Correctional Center

- 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.



Example: Energy Savings as Financing = Jobs

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



\$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

State Resources
CT Department of Mental Health & Addiction Services | Connecticut Valley Hospital
CT Department of Energy & Environmental Protection | Lead by Example
CT Department of Administrative Services



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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	\$212,912	1,353	42%	\$25,904	448
Exterior & Street Lighting Upgrades	\$35,015	234	42%	\$4,260	102
Lighting Controls	\$21,433	143	42%	\$2,608	62
Steam Distribution Upgrades	\$332,531	4,713	11%	\$0	-
1.5 Megawatt Cogeneration System	\$690,107	TBD	15%	\$0	-
Energy Management System Upgrades & Retro-Commissioning	\$140,119	1,585	15%	\$0	-
New Energy Efficient Chillers	\$49,815	333	81%	\$0	-
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%	\$0	-
Fuel Switching	\$31,140	184	7%	\$0	-
Electric Vehicle Solar Carport Charging Station	\$0	0	11%	\$0	-
New 600HP Power Plant Boilers	\$65,155	893	23%	\$0	-
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.

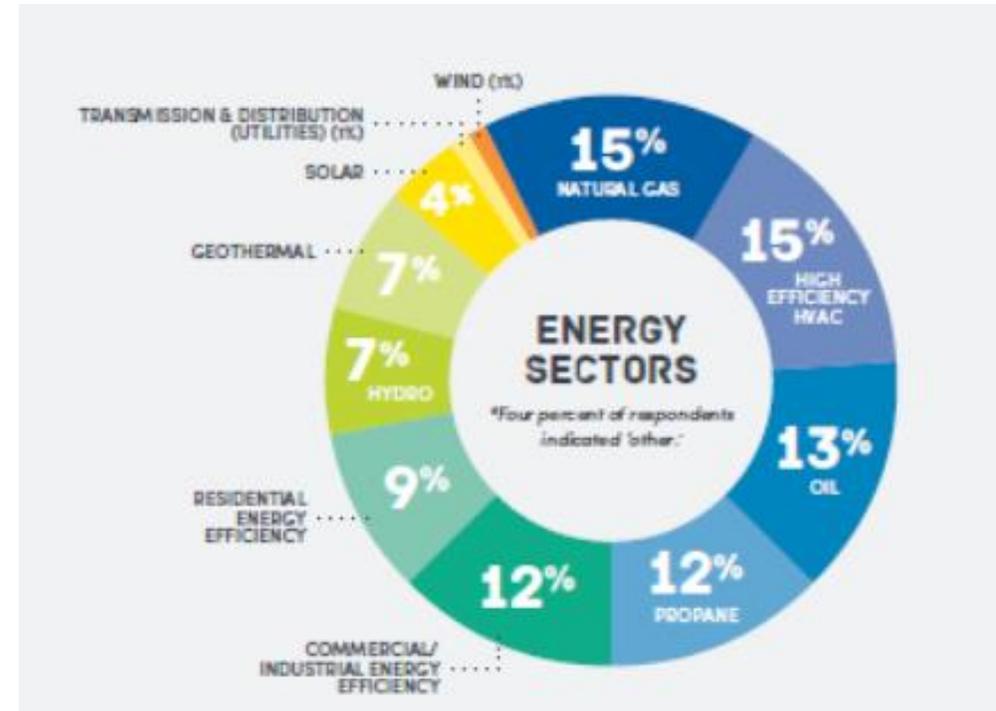
- **The rate for state agencies: The price is 7.533 cents per kWh.**
 - That pricing is better than the Standard Service pricing through December 2017, which for Eversource is 8.01 cents, and for UI is 7.60 cents.
 - Similar competitive pricing achieved through contract extension for SFY19
- **Effective 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.**



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



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, 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.

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



Connecticut Department of Energy and Environmental Protection

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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.

NEED 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



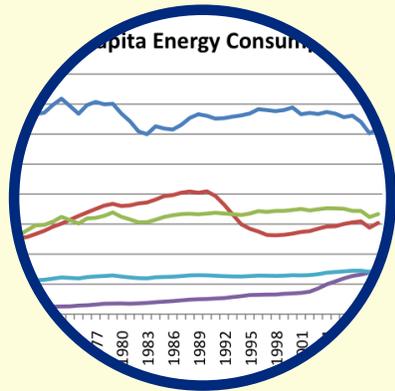
Strategic Plan for Better State Buildings



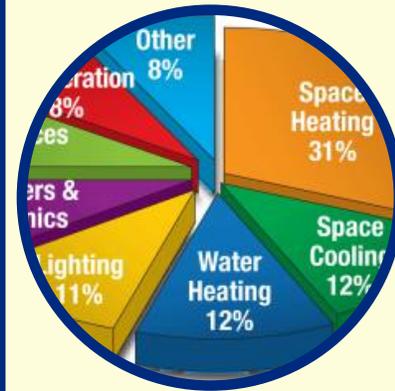
Inventory Facilities Universe
[data collection and correlation]



Benchmarking and Procurement
[compare energy use to prioritize; update documents, contracts, and processes; identify financing mechanisms]



Screening
[for potential opportunities; conduct feasibility analyses for renewables generation; consider consistency with state and local plans]



Energy Assessments
[various audit levels, depending on purpose and funding source]



Measure Progress
Efficiency measures and renewable energy generation financed, installed, and remain effective into the future



Thank you!

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Bureau of Energy and Technology Policy

