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

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.
~70 million square feet of state structures

State Owned Structures (3822)
- 66.9 million total square feet
- 33 agencies/districts owning structures (i.e., unique agency code numbers)

State Leased Buildings (189)
- 2.9 million total square feet

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.*

Connecticut Department of Energy and Environmental Protection
Agency Analyses

Connecticut Department of Energy and Environmental Protection
Connecticut Department of Energy and Environmental Protection

Analyze Usage Trends by Agency and Building
Analyze Cost Trends by Agency and Building

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*

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Estimated Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric</td>
<td>3816 million kWh</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>1032 million kWh</td>
</tr>
<tr>
<td>Deliverable Fuels</td>
<td>360 million kWh</td>
</tr>
<tr>
<td>Water</td>
<td>1006 million kWh</td>
</tr>
<tr>
<td>Other</td>
<td>198 million kWh</td>
</tr>
</tbody>
</table>

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

Estimated 611 million Annual total kWh | 2.5 million DTh Natural Gas
State Agencies’ Annual Energy Consumption and Spending

FY17 State Est. Energy Cost & Use (MMBtu)

Includes all energy types for building consumption including: electricity, natural gas, fuel oil, propane, hot & chilled water & steam.

<table>
<thead>
<tr>
<th>Division</th>
<th>Total $</th>
<th>Total MMBTU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Executive</td>
<td>$37,830,501</td>
<td>1,330,007</td>
</tr>
<tr>
<td>Higher Ed</td>
<td>$33,801,904</td>
<td>2,233,574</td>
</tr>
<tr>
<td>Judicial</td>
<td>$4,481,835</td>
<td>101,366</td>
</tr>
<tr>
<td>QuasiPublic</td>
<td>$1,512,156</td>
<td>42,065</td>
</tr>
<tr>
<td>Legislative</td>
<td>$495,035</td>
<td>13,447</td>
</tr>
</tbody>
</table>

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

- UCONN, 18%
- CSCU, 22%
- DOC, 8%
- DAS, 10%
- DOT, 10%
- DCF, 1%
- DDS, 2%
- DMSHAS, 4%
- DEEP, 2%
- MIL, 3%
- JUD, 4%
- Joint Committee On Legislative Management, 1%
- SDE, 5%
- OPM, 1%

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

Source: CT DEEP, 2018 analysis of CY2017 available data
• 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*

*Snapshot of the information currently available, the data is not 100% complete
## Top 25 Buildings by Estimated Annualized Cost (less Higher Education)

<table>
<thead>
<tr>
<th>Building Name</th>
<th>Location</th>
<th>ID</th>
<th>Agency</th>
<th>Sq. Ft.</th>
<th>Est. Annualized Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hangar - TASMG</td>
<td>CTNG - TASMG Groton</td>
<td>2201-46</td>
<td>MIL</td>
<td>126,841</td>
<td>$3,231,078.89</td>
</tr>
<tr>
<td>MacDougall Correctional Institution</td>
<td>MacDougall Ct, Suffield</td>
<td>8000-161</td>
<td>DOC</td>
<td>480,680</td>
<td>$1,565,736.96</td>
</tr>
<tr>
<td>State Armory Westbrook</td>
<td>Westbrook Armory</td>
<td>2201-73</td>
<td>MIL</td>
<td>13,929</td>
<td>$1,557,647.01</td>
</tr>
<tr>
<td>State Armory Vernon/Rockville</td>
<td>CTNG Vernon-Rockville</td>
<td>2201-71</td>
<td>MIL</td>
<td>13,999</td>
<td>$1,094,918.80</td>
</tr>
<tr>
<td>470 Capitol Ave</td>
<td>Hartford</td>
<td>1326-486</td>
<td>DAS</td>
<td>31,735</td>
<td>$1,026,704.86</td>
</tr>
<tr>
<td>Connecticut River Plaza</td>
<td>Hartford</td>
<td>1326-8240</td>
<td>DAS</td>
<td>914,457</td>
<td>$941,034.48</td>
</tr>
<tr>
<td>Barracks - 803</td>
<td>CTNG Camp Nianic E Lyme</td>
<td>2201-206</td>
<td>MIL</td>
<td>19,191</td>
<td>$916,104.98</td>
</tr>
<tr>
<td>505 Hudson St</td>
<td>Hartford</td>
<td>1326-481</td>
<td>DAS</td>
<td>155,264</td>
<td>$910,134.92</td>
</tr>
<tr>
<td>GA20 Courthouse Norwalk</td>
<td>Norwalk</td>
<td>9001-20</td>
<td>JUD</td>
<td>33,000</td>
<td>$865,377.58</td>
</tr>
<tr>
<td>Barracks - 802</td>
<td>CTNG Camp Nianic E Lyme</td>
<td>2201-205</td>
<td>MIL</td>
<td>19,191</td>
<td>$856,293.65</td>
</tr>
<tr>
<td>Dept of Insurance</td>
<td>960 Main, Hartford</td>
<td>064-12</td>
<td>DAS</td>
<td>41,887</td>
<td>$800,084.02</td>
</tr>
<tr>
<td>Administration Building - HQ</td>
<td>Newington</td>
<td>5000-4252</td>
<td>DOT</td>
<td>363,719</td>
<td>$700,455.56</td>
</tr>
<tr>
<td>Office Building 55 Farmington</td>
<td>Hartford</td>
<td>1326-8239</td>
<td>DAS</td>
<td>384,808</td>
<td>$590,945.95</td>
</tr>
<tr>
<td>79 Elm St</td>
<td>Hartford</td>
<td>1326-32</td>
<td>DAS</td>
<td>280,300</td>
<td>$582,914.23</td>
</tr>
<tr>
<td>Southeastern Mental Health</td>
<td>Uncas On Thames, Norwich</td>
<td>1303-530</td>
<td>DAS</td>
<td>55,264</td>
<td>$541,323.76</td>
</tr>
<tr>
<td>Norwich Branch</td>
<td>Norwich</td>
<td>2101-9</td>
<td>DMV</td>
<td>5,014</td>
<td>$535,117.08</td>
</tr>
<tr>
<td>25 Sigourney St</td>
<td>Hartford</td>
<td>1326-480</td>
<td>DAS</td>
<td>467,000</td>
<td>$516,258.89</td>
</tr>
<tr>
<td>Rowland State Government Center</td>
<td>55 W Main, Waterbury</td>
<td>1326-7101</td>
<td>DAS</td>
<td>99,691</td>
<td>$424,581.50</td>
</tr>
<tr>
<td>Platt Regional Vocational Technical School</td>
<td>Platt RVTS, Milford</td>
<td>7001-16</td>
<td>SDE</td>
<td>221,320</td>
<td>$420,069.50</td>
</tr>
<tr>
<td>Eli Whitney Regional Vocational Technical School</td>
<td>Whitney THS Hamden</td>
<td>7001-8</td>
<td>SDE</td>
<td>178,763</td>
<td>$418,545.36</td>
</tr>
<tr>
<td>State Capitol Building</td>
<td>Hartford</td>
<td>1001-14</td>
<td>OLM</td>
<td>181,000</td>
<td>$415,499.63</td>
</tr>
<tr>
<td>Norwich Regional Vocational Technical School</td>
<td>Norwich RVTS</td>
<td>7001-14</td>
<td>SDE</td>
<td>99,626</td>
<td>$403,698.37</td>
</tr>
<tr>
<td>Power Plant</td>
<td>Rocky Hill</td>
<td>1312-6</td>
<td>DVA</td>
<td>29,115</td>
<td>$401,584.69</td>
</tr>
<tr>
<td>DOC HQ - 24 Wolcott Hill Rd</td>
<td>Wethersfield</td>
<td>1326-6</td>
<td>DAS</td>
<td>115,000</td>
<td>$377,212.45</td>
</tr>
<tr>
<td>61 Woodland Street</td>
<td>Hartford</td>
<td>1326-8532</td>
<td>DAS</td>
<td>213,421</td>
<td>$372,935.27</td>
</tr>
</tbody>
</table>

Source: CT DEEP, 2017
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

State agencies have a variety of different building uses. Below is a list of selected buildings at least 10,000 sq. ft.:  

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

First 3 are Power Plants
Benchmarked 27 million s.f. at 276 state buildings
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

- Connecticut State Library
- Department of Administrative Services
- Department of Children & Families
- Division of Criminal Justice
- Department of Developmental Services
- Department of Energy and Environmental Protection
- Department of Emergency Services & Public Protection
- Department of Mental Health & Addiction Services
- Department of Correction
- Department of Labor
- Department of Transportation
- Judicial
- State Department of Education
72 Projects approved, resulting in estimated 89.3 billion BTUs reduced and $2.91M savings annually. Average 5.9 year payback.

Bond funding fully expended as of January 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.

![Diagram of energy usage and cost comparison](image-url)
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
## CVH ESPC Savings during Construction Phase

<table>
<thead>
<tr>
<th>Energy Conservation Measures</th>
<th>Estimated Energy Savings Annually ($)</th>
<th>Estimated Energy Savings Annually (mmBtu)</th>
<th>Construction Percent Complete</th>
<th>Estimated Energy Savings To Date ($)</th>
<th>Estimated Energy Savings To Date (mmBtu)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interior Lighting Upgrades</td>
<td>$212,912</td>
<td>1,353</td>
<td>42%</td>
<td>$25,904</td>
<td>448</td>
</tr>
<tr>
<td>Exterior &amp; Street Lighting Upgrades</td>
<td>$35,015</td>
<td>234</td>
<td>42%</td>
<td>$4,260</td>
<td>102</td>
</tr>
<tr>
<td>Lighting Controls</td>
<td>$21,433</td>
<td>143</td>
<td>42%</td>
<td>$2,608</td>
<td>62</td>
</tr>
<tr>
<td>Steam Distribution Upgrades</td>
<td>$322,531</td>
<td>4,713</td>
<td>11%</td>
<td>$0</td>
<td>-</td>
</tr>
<tr>
<td>1.5 Megawatt Cogeneration System</td>
<td>$690,107</td>
<td>TBD</td>
<td>15%</td>
<td>$0</td>
<td>-</td>
</tr>
<tr>
<td>Energy Management System Upgrades &amp; Retro-Commissioning</td>
<td>$140,119</td>
<td>1,585</td>
<td>15%</td>
<td>$0</td>
<td>-</td>
</tr>
<tr>
<td>New Energy Efficient Chillers</td>
<td>$49,815</td>
<td>333</td>
<td>81%</td>
<td>$0</td>
<td>-</td>
</tr>
<tr>
<td>New Windows</td>
<td>$120,507</td>
<td>1,588</td>
<td>2%</td>
<td>$1,205</td>
<td>186</td>
</tr>
<tr>
<td>Energy Efficient Transformers</td>
<td>$1,782</td>
<td>12</td>
<td>22%</td>
<td>$294</td>
<td>7</td>
</tr>
<tr>
<td>Pipe &amp; Mechanical Equipment Insulation</td>
<td>$60,688</td>
<td>860</td>
<td>98%</td>
<td>$28,018</td>
<td>4871</td>
</tr>
<tr>
<td>Steam Trap Repair &amp; Replacements</td>
<td>$77,516</td>
<td>1,099</td>
<td>63%</td>
<td>$5,814</td>
<td>1012</td>
</tr>
<tr>
<td>Pool Upgrades</td>
<td>$2,520</td>
<td>23</td>
<td>5%</td>
<td>$0</td>
<td>-</td>
</tr>
<tr>
<td>Fuel Switching</td>
<td>$31,140</td>
<td>184</td>
<td>7%</td>
<td>$0</td>
<td>-</td>
</tr>
<tr>
<td>Electric Vehicle Solar Carport Charging Station</td>
<td>$0</td>
<td>0</td>
<td>11%</td>
<td>$0</td>
<td>-</td>
</tr>
<tr>
<td>New 600HP Power Plant Boilers</td>
<td>$65,155</td>
<td>893</td>
<td>23%</td>
<td>$0</td>
<td>-</td>
</tr>
</tbody>
</table>

**TOTAL PROJECT SAVINGS TO DATE**: $68,102, 6,688 mmBtu
Competitive Purchase of Aggregated Electricity Supply


- **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
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.

https://www.tunxis.edu/completion/energy-management
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
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!

Diane W. Duva, Director, Office of Energy Demand
Diane.Duva@ct.gov  860-827-2756

Ryan C. Ensling, Research Analyst, Office of Energy Demand
LeadByExample@ct.gov

Bureau of Energy and Technology Policy