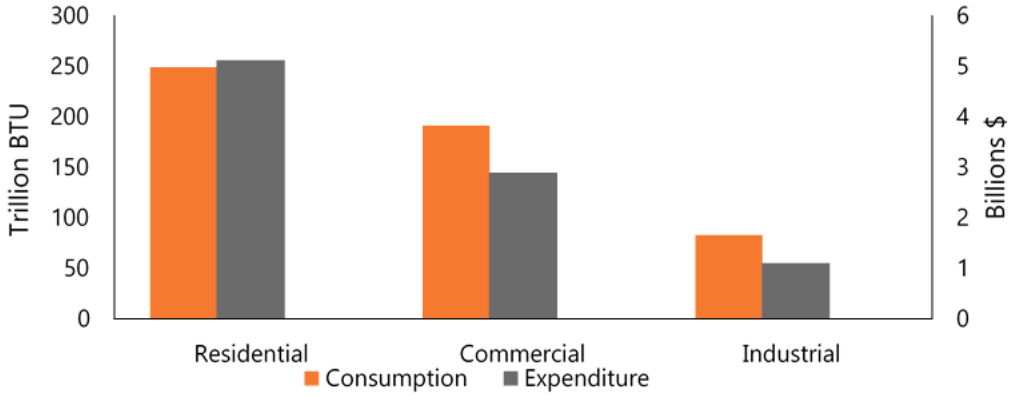
Buildings Sector

Energy Usage

Today, Connecticut's 1.4 million households and 140,000 businesses together account for more than 70 percent of Connecticut's 750 trillion BTU of annual energy consumption, approximately 523 trillion BTU.[1] However, buildings do not all consume energy in the same way.

Residential Energy Consumption

FIGURE B1: Connecticut Building Sector Energy Consumption & Expenditures



Source: U.S. EIA *Connecticut State Profile and Energy Estimates*, 2017.

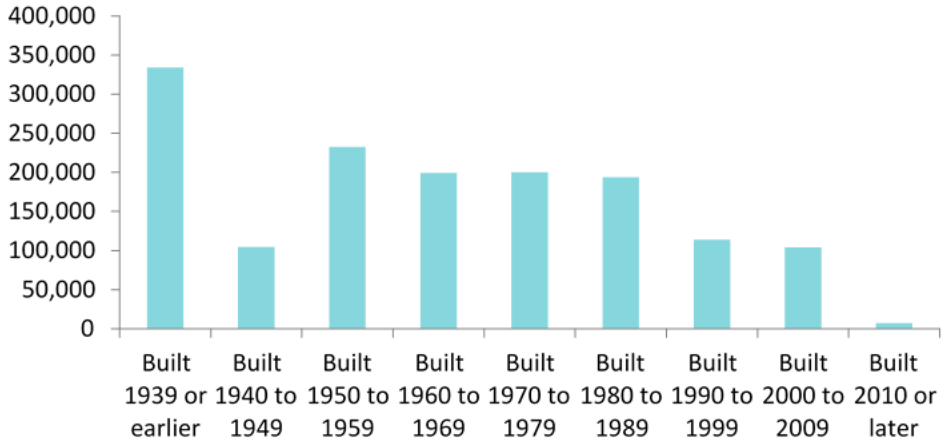
The residential segment consumed nearly half of the building sector's energy in 2015 at 249 trillion BTUs, with Connecticut residents spending $4.7 billion (Figure B1).[2,3,4] Since the peak of energy use in 2004, total residential BTU consumption has fallen by about 17 percent overall but has been slowly on the rise since 2011, primarily due to increased natural gas consumption.[5]

[1] United States Energy Information Administration "Energy Consumption Overview: Estimates by Energy Source and End-Use Sector, 2014", 2014, http://www.eia.gov/state/seds/data.php#ConsumptionExpenditures.
[2] It is important to keep the total number of customers in each sector in mind when thinking about energy demand and expenditures since the average industrial customer will of course consume more energy than the average home.
[3] United States Energy Information Administration, "Energy Consumption Estimates by End-Use Sector, Ranked by State" 2014, http://www.eia.gov/state/seds/data.php?incfile=/state/seds/sep_sum/html/rank_use.html&sid=US.
[4] United States Energy Information Administration, "Connecticut State Profile and Energy Estimates", 2017, http://www.eia.gov/state/data.php?sid=CT#ConsumptionExpenditures
[5] United States Energy Information Administration, "Table C1. Energy Consumption Overview: Estimates by Energy Source and End-Use Sector, 2014), *U.S. States State Profiles and Energy Estimates* , 2014, https://www.eia.gov/state/seds/data.php.

Thermal Fuels

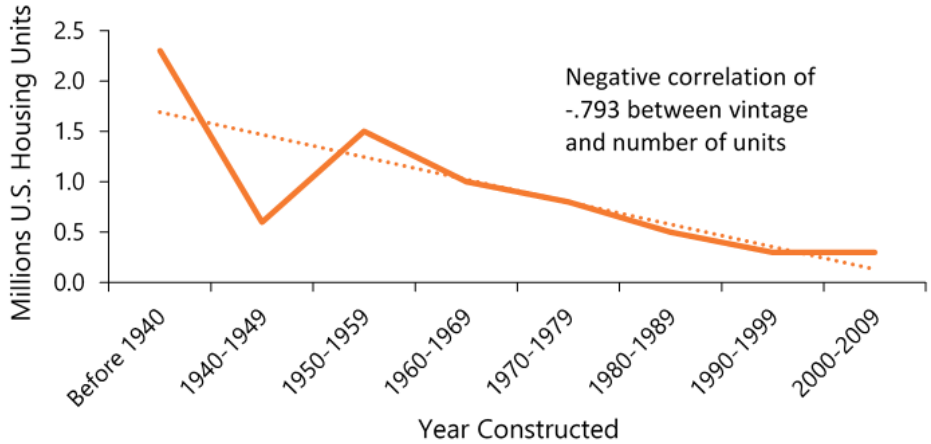
This level of consumption is a result of a combination of trends in Connecticut's housing stock. Almost 72 percent of Connecticut's housing units were built before 1979 (Figure B2). Statistically, older homes are less insulated, and use outdated and less efficient appliances and equipment, which results in higher energy costs. Additionally, fossil fuels, particularly fuel oil, are heavily used for thermal fuel in Connecticut homes, especially in older homes (Figure B3). Over 40 percent of Connecticut housing units use fuel oil for space heating, compared to just 5 percent nationwide (Figure B4).

FIGURE B2: Connecticut Housing Stock by Vintage



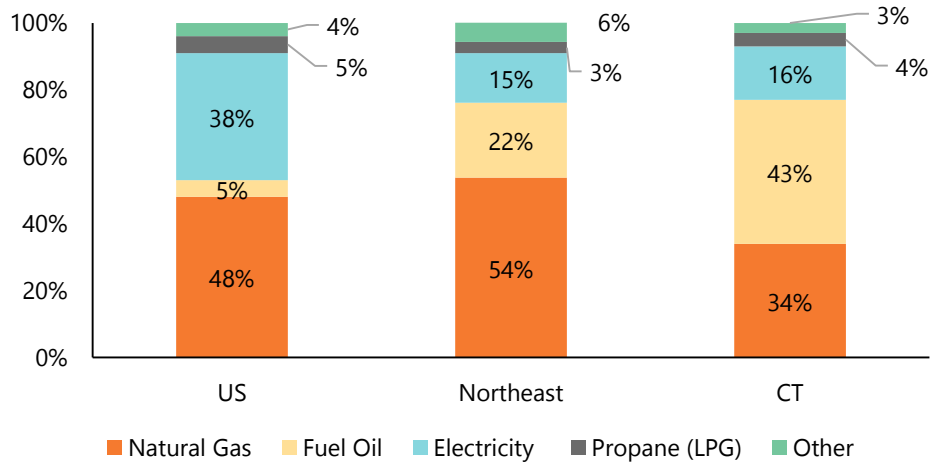
Source: United States Census Bureau. 2015. *Connecticut Selected Housing Characteristics 2011-2015 American Community Survey 5-Year Estimates.*

FIGURE B3: Fuel Oil Used For Space Heating By Housing Vintage (U.S.)



Source: U.S. EIA. 2013. *2009 Residential Energy Consumption Survey: Table HC1.3*

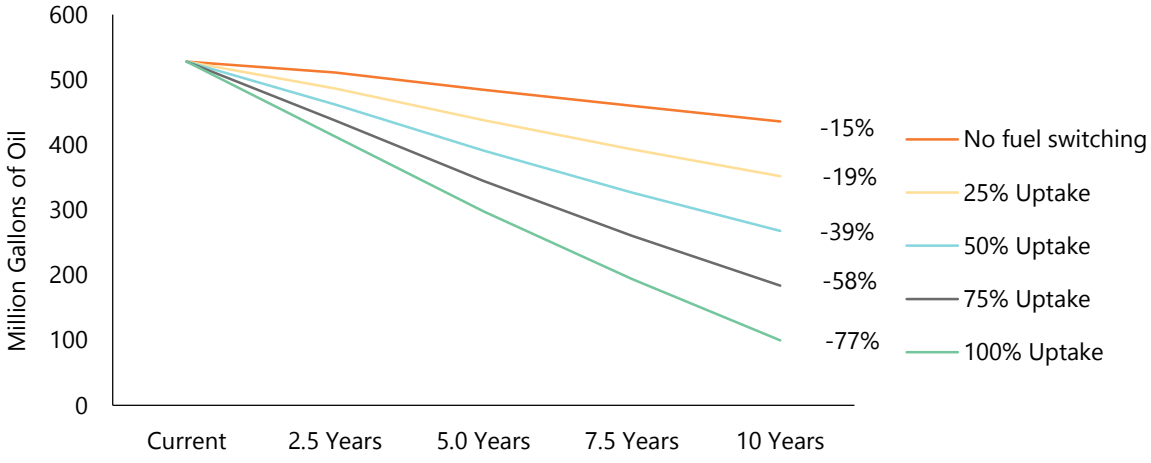
FIGURE B4: Primary Energy Source for Space Heating by Percent of Total Households



Source: U.S. Census Bureau, 2016 American Community Survey.
U.S. Energy Information Administration, 2015 Residential Energy Consumption Survey.

However, current trends show that due to improved energy efficiency and more affordable thermal resources becoming available, oil consumption is expected to decline over the next ten years. American domestic oil prices are down since their peak in mid-2008 as a reflection of increased supply and decreasing demand.[6] Fuel oil consumption is currently declining at a rate of -2.1 percent per year, yet efficient electric heat pumps and efficient gas equipment are growing

FIGURE B5: Projected Changes in Fuel Oil Consumption with Fuel Switching Over Time



Source: NMR Group, Inc. 2016. *R15: Connecticut Single-Family Potential Study.*

[6] United States Energy Information Administration. 2017. *Petroleum and Other Liquids.* 1 March. https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=F000000__3&f=M.

by 1 percent and 0.7 percent.[7] A 2016 study of Connecticut Single-Family buildings reflected this change in demand by projecting that over the next ten years, changing to natural gas or efficient electric without utility incentives in single family homes could decrease heating fuel oil consumption by 77 percent, as shown by Figure B5.[8] Even if Connecticut takes no action to advance less carbon intensive fuel choices, consumption is still expected to decrease by 15 percent of the next ten years.

This anticipated shift in residential heating fuel oil consumption represents an opportunity for the delivered fuel oil industry to advance and adapt to changing economic and technological climates and to fill a niche not yet expanded upon. Given the proper tools and alignment, this can have important beneficial effects on Connecticut's environment and economy.

Demographics and Energy Affordability

Connecticut is often characterized as rural or suburban, and very wealthy. In actuality, it is the fourth most densely populated state in the US and approximately 88 percent of the population lives in an urban area with a range of income classes throughout the state.[9] Approximately one third of Connecticut's occupied housing units are rentals, which limits the direct control residents have over their energy choices and costs. This is particularly true in multifamily housing in which the units are often not owner-occupied.[10]

Additionally, approximately 22 percent of Connecticut's households live with an income at or below 200 percent of the federal poverty levels. It is in these homes that the intersection between energy, income, health and safety is most evident. For many homes, energy expenses constitute greater proportions of household income and compete with housing, food, and medical care. Low-income homes are also often older, are not as well insulated, and have maintenance challenges, including health and safety issues that hinder completion of weatherization improvements. Even with support from programs such as the federal Low-Income Home Energy Assistance Program (LIHEAP) and utility administered matching payment plans, low-income households often must choose between vital necessities.

[7] NMR Group, Inc. 2016. R15: Connectiuct Single-Family Potential Study.
[8] Id.
[9] Connecticut Department of Public Health. 2012. *Connecticut Healthy Homes Data Book*. Connecticut Department of Public Health. http://www.portal.ct.gov/-/media/Departments-and-Agencies/DPH/dph/environmental_health/eoha/pdf/HHDataBookpdf.pdf?la=en
[10] Connecticut Green Bank. 2016. "Comprehensive Plan Fiscal Years 2017 and 2018", *Connecticut Green Bank,* http://www.ctgreenbank.com/wp-content/uploads/2016/07/CTGreenBank-Comprehensive-Plan-Fiscal-Years-2017-2018.pdf.

Operation Fuel's 2017 report on Home Energy Affordability in Connecticut estimated an "affordable" energy cost burden to be 6 percent of household income, yet many Connecticut residents spend from 8 percent to 36 percent of household income on energy.[11] This is particularly apparent in Connecticut's 322,000 low-income households whose average affordability gap is around $1,404.[12] In aggregate, this gap is roughly $450 million which is partially attributable to the increase in fuel oil and natural gas prices during the 2016/2017 heating season. [13]

Energy affordability is a statewide issue as these trends, combined with current rates and energy prices, have resulted in Connecticut residents maintaining some of the highest annual energy bills in the nation. This occurs even while Connecticut's residents consume energy at a relatively low per capita rate.[14] Achieving affordable energy costs for all residents is a priority for DEEP.

Connecticut's Renewable Portfolio Standard's (RPS) goal of 20 percent Class I renewable power by 2020 is inclusive of all Connecticut communities.[15] Renewable energy can help to significantly reduce or even eliminate energy bills in households struggling with energy affordability. In 2015, DEEP was authorized to procure renewable energy on behalf of all electric customers. Such procurements provide a cost-effective source of renewable energy, ensuring that all customers are participating in the use of utility-scale renewable energy. In 2016, Connecticut also began offering an affordable financing and solar lease product through the Connecticut Green Bank. This product combines energy efficiency and renewable energy generation installation to maximize energy and cost savings without high upfront costs. DEEP continues to move forward with the implementation of a shared clean energy pilot program to evaluate a broader framework to deploy clean energy to low-income households.

Additionally, Connecticut has been a key participant in the Clean Energy for Low-Income Communities Accelerator (CELICA), sponsored by the federal DOE and the National Renewable Energy Laboratory (NREL). This program has provided an avenue for states to share policy outcomes and work together to increase availability to vulnerable communities. Participation in the Accelerator has enriched Connecticut's ability to better target multifamily customers as a way to reach the low to moderate income customer base and improve energy affordability for the households in it. DEEP and the Connecticut Green Bank will continue to represent Connecticut in

[11] Colton, Roger D. 2017. "Home Energy Affordability in Connecticut: The Affordability Gap, Prepared for Operation Fuel." http://www.operationfuel.org/wp-content/uploads/2017/12/2017-ConnecticutHEAG-11-27-17-RDC-edits.pdf
[12] This number does not represent the total energy costs per household but rather the portion beyond the affordable amount. The 2015 ACS identified this number of households as at or below 200 percent of the Federal poverty level.
[13] Colton, Roger D. 2017. "Home Energy Affordability in Connecticut: The Affordability Gap, Prepared for Operation Fuel." http://www.operationfuel.org/wp-content/uploads/2017/12/2017-ConnecticutHEAG-11-27-17-RDC-edits.pdf
[14] "Household Energy Use in Massachusetts." *www.eia.gov.* 2009, http://www.eia.gov/consumption/residential/reports/2009/state_briefs/pdf/ma.pdf.
[15] See C.G.S. §16-1(a)(20) for definition of Class I renewable energy.

this federal Accelerator initiative to move towards even greater equitable distribution of renewable energy integrated with energy efficiency across the state.

Health and Safety Barriers to Weatherization

Since 2016, Eversource has been collecting data on the type and frequency of barriers preventing completion of a home energy assessment. The collections have found that on average, 25 percent of homes participating have at least one health or safety issue limiting weatherization services. These findings indicate how traditionally health-related problems like asbestos, mold, carbon monoxide leaks, and more, are very much integrated with energy. As a result, unhealthy and inefficient homes cost Connecticut millions of dollars every year in the form of unaffordable energy bills and health costs. The energy affordability gap in Connecticut often exceeds $400 million, while an estimated $54 million in hospitalizations and emergency room visits for acute asthma treatment alone can be attributed to home-based environmental hazards. It has also been found that poor housing quality can be a significant cause of increased rates of anxiety and depression in both children and adults.[16]

These effects can all be mitigated by improved weatherization programs alleviate both energy and health burdens allowing occupants to live healthier, more prosperous lives that promote economic development in their communities.

TABLE B1: NON-ENERGY BENEFITS OF WEATHERIZATION SERVICES

Property Insurance Benefits	Health Insurance Benefits
• Reduced combustion fuel leaks	• Reduced asthmatic triggers (mold/moisture)
• Reduced fire hazard	• Indoor air temperature stabilization
• Reduced ice and snow damage	• Reduced environmental stress and anxiety triggers
• Reduced pest damage	• Reduced carbon monoxide poisoning risk
• Increased property value	• Reduced physician office and emergency room visits
• Window and incidental repairs	• Reduced presence of allergens

Source: Oak Ridge National Laboratory. "*Health and Household-Related Benefits Attributable to the Weatherization Assistance Program.*" 2014.

These benefits exist outside the traditional energy sphere and help prevent the need for both property insurance and health insurance claims by reducing structural, health, and safety hazards in and around the home, thus reducing cost burdens on insurance companies (Table B1). By

[16] Coley, Rebeckha Levine, et al. "Relations between Housing Characteristics and the Well-Being of Low-Income Chilrden and Adolescents." *Development Psychology.* 2013.

collaborating with these sectors not traditionally linked to energy, Connecticut has the potential to create a long-term, sustainable funding mechanism that will be able to provide the energy and health benefits associated with weatherization well into the future.

Currently, the Green Bank, DEEP, the Department of Public Health (DPH), the Green and Healthy Homes Initiative (GHHI), the Department of Housing, the Department on Aging, the Department of Children and Families, the Office of Early Childhood, the Office of the Chief State's Attorney and the utilities have begun a collaborative to provide holistic solutions that address this intersection of energy, health and safety issues. The primary focus of this collaborative is to identify sustainable funding resources from the health sector, and integrate them with comprehensive, and cost-effective housing intervention programs that create healthier environments and reduce health and energy costs. GHHI describes the long term vision for this collaboration as "a future…where any family across Connecticut—whether they come to a health facility for treatment of asthma, contact their utility for energy efficiency services, or seek housing repairs from a local social service nonprofit—would get the package of interventions needed to make their home green, safe and healthy." [17]

The Unique Energy Needs of Multifamily Buildings

The multifamily residential category, until recently, has remained a relatively untapped source of energy efficiency potential. However, accessing this residential category will require a much different approach than single family. These buildings often are not owner-occupied, and that technically speaking, upgrades can be treated similarly to commercial buildings. This creates challenges in communication and financing projects. Furthermore, multifamily energy consumption has not been studied or tracked in Connecticut as intensely as single family buildings making it difficult to prescribe direct energy savings measures. Additionally multifamily properties

TABLE B2: Typologies of Multifamily Markets

Typology	Variations
Type of Rental Housing Market	Affordable vs. Market Rate
Type of Building and Size	Small Properties, High Rises, Town Houses, Complexes
Type of Resident	General Population, Seniors, Students
Type of Ownership	Single Owner, Corporate Owner, Local Public Housing Authority
Type of Utility Metering Method	Master Metered vs. Individually Metered

Source: Ross et. al, 2016. *Reaching More Residents: Opportunities for Increasing Participation in Multifamily Energy Efficiency Programs.*

[17] Green and Healthy Homes Initiative. Connecticut Green & Healthy Homes Project Needs Justification Statement. October 2017.

can vary greatly in characteristics statewide. A 2016 ACEEE report outlined five major typologies of multifamily buildings presented in Table B2.

Each of these typologies requires tailored approaches to implementation. The type of rental housing market will need to account for the challenges that low-income residents face. Likewise, the type of resident and type of ownership will need to address the fact that, for example, students live for very short periods of time in rental properties owned by their school or a landlord and will have limited control over energy and efficiency measures. DEEP and its energy efficiency partners have created or are developing effective solutions to reach these customers.

In the Connecticut Green Bank's 2017-2018 Comprehensive Plan, it evaluated the current Connecticut housing market. It found that of the approximately 445,000 low income households in Connecticut, 64 percent were rentals, and that of that 58 percent were multifamily buildings of five or more units.[18] Approximately 90 percent of larger multifamily buildings (20+ unit) are concentrated in 38 municipalities and about 50 percent are in five core municipalities (Stamford, Hartford, New Haven, Bridgeport and Waterbury).[19] DEEP continues to support ongoing coordinated efforts to increase energy efficiency in multifamily housing, which are currently being administered by the utility companies, the Connecticut Green Bank, and CHFA.

Obstacles to efficiency investment

The types of properties served by the Multi-Family Initiatives of the utility-administered program and the Connecticut Green Bank financing products cover the full range of properties, from old converted single family homes to large apartment and condo complexes. Many of these buildings are not owner-occupied, meaning targeting the actual residents is nearly useless. Contacting the right person with program information is imperative to successful authorization of energy efficiency improvements.

Split incentives are also important in this context because they result from the property owner providing the investment, but not necessarily receiving all the benefits, as a single-family owner might. It is important that multifamily program staff and vendors highlight the non-energy benefits of efficiency improvements like enhanced comfort and aesthetics, increased tenant satisfaction and retention, and in the case of affordable housing, lower energy bills equates to a lower cost of living, and a higher likelihood that rents will be paid. Development of utility

[18] Connecticut Green Bank. 2016. "Comprehensive Plan Fiscal Years 2017 and 2018."
[19] Connecticut Housing Finance Authority. 2013. "*Connecticut Affordable Housing Market Inventory Study.*" http://www.ct.gov/opm/lib/opm/hhs/interagency_council_on_affordable_housing/meeting_2013_12-03/final-report-11-12-13.pdf

allowance structures and sub metering strategies that encourage property owners to participate and reduce tenants' high energy burdens can help with this.[20] [21]

The utility companies have embarked on a customized approach to implementing efficiency measures at multifamily properties that is catalyzing activity in this subsegment. This approach includes coordinating with the Connecticut Housing Finance Authority (CHFA) and the Connecticut Green Bank to ensure that utility incentives, CHFA opportunities, and Connecticut Green Bank financing products are optimized and coordinated early in the project development process.

From initiation through project completion, the implementation of energy efficiency measures can be a complex and daunting process for building owners and managers. In pursuit of simplifying and streamlining the process of financing multifamily capital improvement projects with an energy efficiency and conservation component, several programs have been developed or improved as a result of interagency collaboration, and such streamlining and coordination must continue.

Commercial & Industrial Consumption

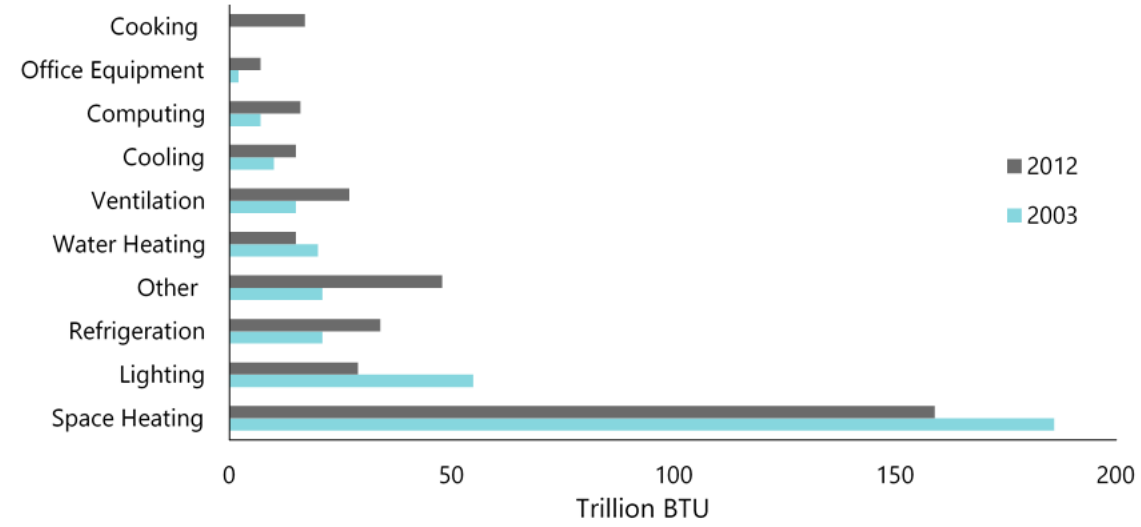
The commercial and industrial segments individually consume less than the residential segment, though together the commercial and industrial segments spent $3.8 billion on 275 trillion BTU of energy in 2015—a little more than half of the Building sector's total expenditure. As in the residential segment, space heating and lighting are the top energy end-uses in commercial and industrial buildings, constituting about half of total consumption nationwide, and one third of consumption in New England.[22] However, compared to the 2003 U.S. Energy Information Administration (EIA) Commercial Building Energy Consumption Survey (CBECS), space heating and lighting energy consumption have decreased by 14 percent and 46 percent respectively in New England commercial and industrial buildings. This is primarily due to warmer winters and the increased market penetration of compact fluorescent (CFL) and light emitting diode (LED) bulbs (as shown in Figure B6). Coincidentally, while lighting and space heating energy usage has decreased since 2003, other end uses such as ventilation, cooling, and refrigeration have grown.

[20] Bell, Casey J., Stephanie Sienkowski, and Sameer Kwatra. 2013. "Financing for Multi-Tenant Building Efficiency: Why This Market is Underserved and What can Be Done to Reach It." *aceee.org*. August. http://aceee.org/sites/default/files/publications/researchreports/e13e.pdf.

[21] NMR Group, Inc. 2016. *R157 Multifamily Initiative Process Evaluation* . Connecticut Energy Efficiency Board, Eversource, and United Illuminating. https://www.energizect.com/sites/default/files/R157%20-%20Multifamily%20Initiative%20Process%20Evaluation,%20Final%20Report,%203.8.16.pdf

[22] United States Energy Information Administration, *2012 Commercial Buildings Energy Consumption Survey (CBECS).* 18 March. http://www.eia.gov/consumption/commercial/reports/2012/energyusage/index.php.

FIGURE B6: New England Commercial and Industrial Energy End-Uses 2003 vs. 2012



Source: U.S. EIA 2003. *2003 Commercial Buildings Energy Consumption Survey (CBECS).* U.S. EIA 2013, *2012 CBECS.*

The United States Environmental Protection Agency's ENERGY STAR program estimates that businesses can cut energy costs by 10 to 30 percent by investing in technologies like high efficiency HVAC, lighting upgrades, building management systems, strategic building design, and more.[23] These upgrades can also improve longevity of equipment by reducing idling time, and reduce GHG emissions. They can also have additional benefits in improved productivity and healthier work environments.

However, each business faces different challenges and requirements based on their location, financial status, energy usage, and business type. By segmenting commercial and industrial businesses based on these characteristics, contractors can better understand these challenges and can customize how to help Connecticut businesses find the most cost-effective energy efficiency improvements that will produce the greatest energy savings. Additionally, segmentation provides insight for correlating total energy savings with how each segment of commercial and industrial customers is pursuing energy efficiency. This allows policy makers to allocate appropriate funding to individual commercial and industrial, such as energy intensive manufacturers, or targeting sectors that are growing rapidly. By focusing on improving these segments' energy efficiency, Connecticut can help commercial and industrial customers to save money on their utility bills, increasing Connecticut's competitive edge in business and industry. Understanding these

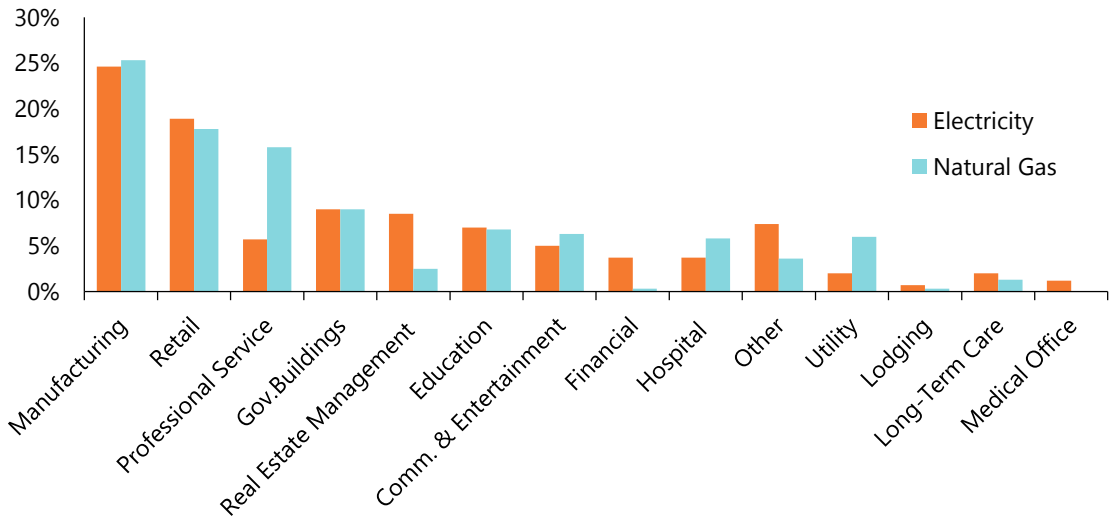
[23] ENERGY STAR. "Buildings & Plants: Save Energy". https://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/save-energy.

customer segments and their different barriers is the first step in recommending strategies to reduce energy demand.

Consumption by Industry Segment

Commercial energy customers vary greatly in size and energy intensity. In fact, only a small number of large businesses consume the majority of energy used by businesses in Connecticut. According to Eversource Energy, a small group of large businesses, primarily manufacturers, comprise this top 25 percent of the Eversource load. The middle 50 percent of energy users is a larger group of customers and includes government agencies, commercial office buildings, education, and large retail buildings. Manufacturing and retail buildings comprise the largest consuming sub-segments of the commercial and building sector (Figure B7).

FIGURE B7: Connecticut Commercial and Industrial Electricity and Natural Gas Consumption by Industry



Source: DEEP's Analysis of the 2016-2018 C&LM Plan Market Segmentation Data

The government segment alone represents approximately 13 percent of the commercial and industrial sector's electric and natural gas consumption in Connecticut.[24] Approximately 3,800 state-owned and state-leased buildings represent 70 million square feet of building space. Many state and municipal buildings in Connecticut are well over 50 years old and are in need of efficiency and maintenance upgrades. Energy efficiency investments have saved Connecticut's state agencies millions of dollars annually, and should be advanced at a larger scale. The companies' Clean Energy Communities program has helped the participating communities

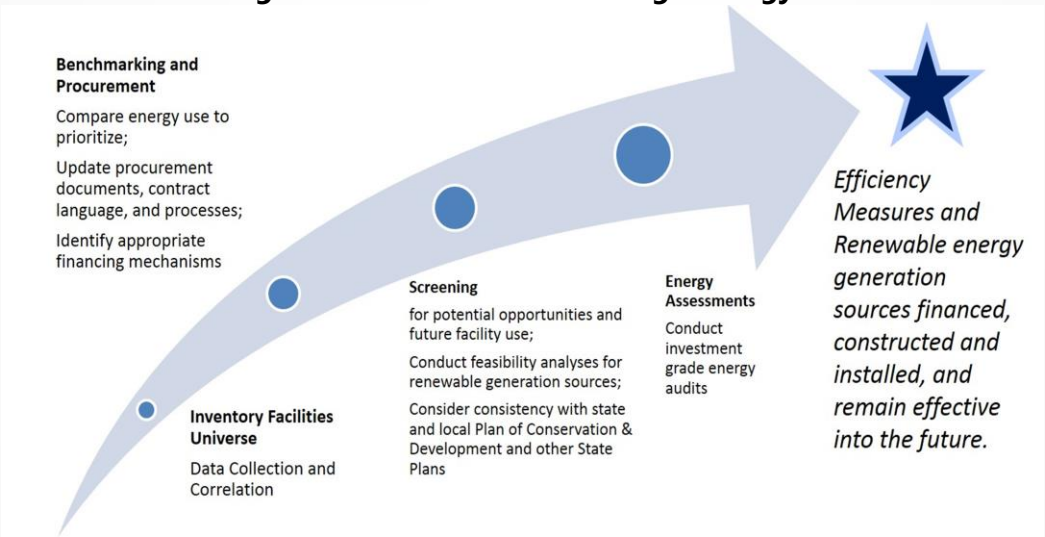
[24] The government segment includes federal, state, and municipal buildings as well as state colleges and universities.

together have saved more than 1.7 billion kWh and 18.6 million ccf from their energy efficiency and renewable energy efforts.[25] This has resulted in 926,806 tons of avoided emissions of CO_2.[26]

Lead By Example

As part of a broader effort to model environmentally preferable practices, since 2013, 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 Connecticut Green Bank, the companies, and others, have advanced the "Lead by Example" energy management programs, including customized initiatives and financing mechanisms to reduce energy use in state buildings. DEEP has developed an implementation pathway to reduce energy costs from state buildings, as illustrated below (Figure B8)

FIGURE B8: Reducing Connecticut's State Buildings' Energy Costs



Source: Connecticut Department of Energy and Environmental Protection, 2016.

Another quarter of consumption results from the majority of businesses, which on an individual company basis consumes lesser amounts of energy, yet in the aggregate consume 25 percent of total electricity and natural gas. This group is comprised of primarily small businesses such as retail stores and office buildings. While per-company energy savings potential from these users

[25] This program provides technical benchmarking support and energy efficiency expertise to municipal buildings and boards of education as well as hands on training for building analytics and energy intensity reporting, as well as training in US EPA Portfolio Manager.

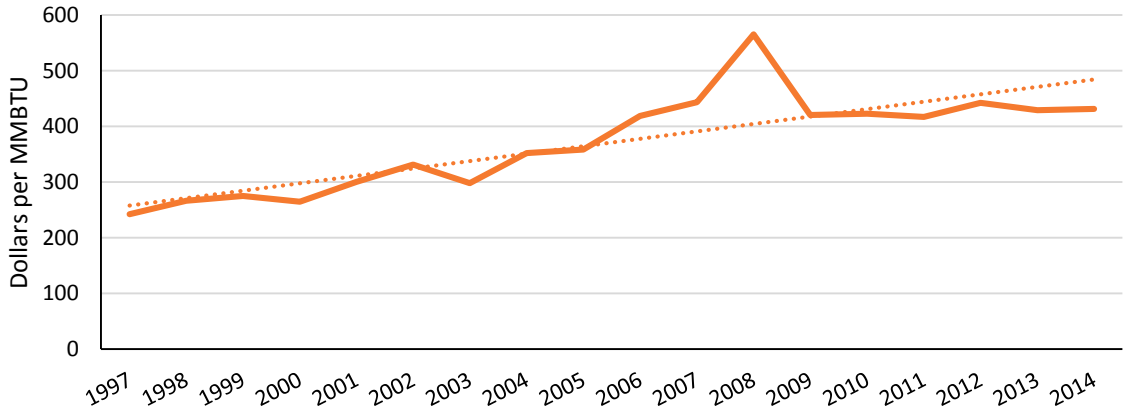
[26] Connecticut Energy Efficiency Fund. 2016. *Energy Efficiency Board 2015 Programs and Operations Report.* Energize Connecticut[SM].

may be relatively small, their overall, large volume creates a major opportunity for aggregated energy and cost savings.

Expenditure and Energy Productivity

Overall, energy expenditure in the commercial and industrial sector has increased by 73 percent since the early 2000s while consumption has declined. While this overall trend is likely attributed to the growth of non-energy-intensive, service-based industry, a more narrow assessment of the manufacturing and industrial production industries reveals the same trends. Annual GDP for Connecticut's industries (manufacturing, non-durable manufacturing, agriculture, fishing, forestry, and construction), have collectively increased by 14% since 1997. The energy consumption for these industries combined has fallen by about 36%, resulting in an average four percent increase per year in energy productivity of manufacturing as shown by Figure B9.[27] This means that Connecticut's businesses are produce an increasing quantity of goods and services per unit of energy. Reducing energy intensity and improving energy productivity usage are a critical strategies businesses can continue employing to control costs and increase energy productivity.

FIGURE B9: Connecticut Industrial Energy Productivity



Sources: Federal Reserve Economic Data, 2017, Connecticut Economic Data. U.S. EIA "Connecticut State Profile and Energy Estimates", 2017.

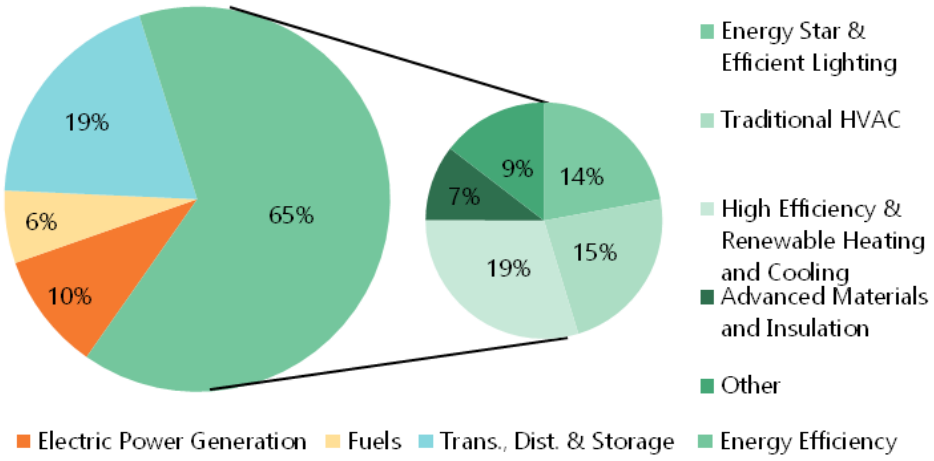
Connecticut's Energy Workforce

Changes in the economy have signaled a shift towards energy efficiency as an industry both nationally and in Connecticut. The United States Department of Energy noted in its January 2017 report on employment in the energy industry that 14 percent of the nation's job growth was seen

[27] United States Energy Information Administration, *Connecticut State Profile and Energy Estimates.* https://www.eia.gov/state/?sid=CT

in the traditional energy and energy efficiency fields.[28] Over 6.4 million Americans worked in these fields in 2016, which equated to a 300,000 job increase. The federal report noted that the design, installation, and manufacture of energy efficiency products and services in Connecticut accounted for nearly 34,000 jobs. Connecticut has been a leader in growing energy efficiency jobs, representing 1.6 percent of all energy efficiency jobs nationally. The largest number of these employees work in high efficiency HVAC and renewable heating and cooling technologies, followed by traditional HVAC (Figure B10). The growth of the industry is strengthened by the predictable investments in energy efficiency across the state's economy.

FIGURE B10: Connecticut Energy Employment by Major Technology



Source: United States Department of Energy, 2017

Energy Efficiency and Renewable Energy Job Training Programs at the Technical High Schools.

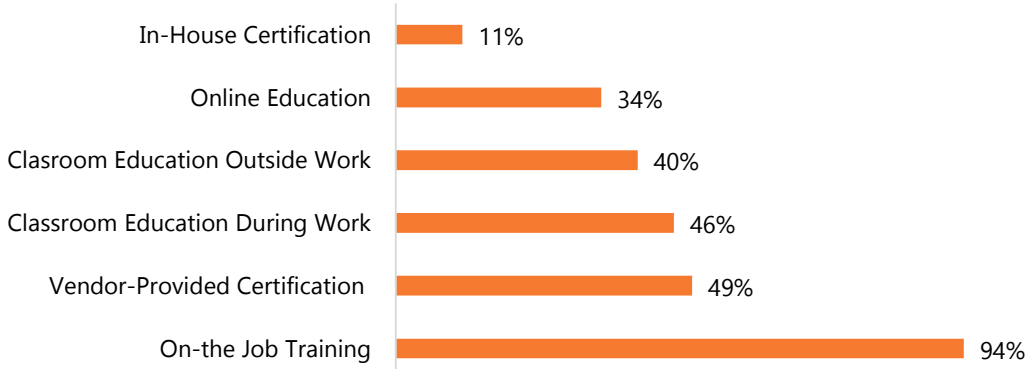
The technical high schools have an initiative in the construction career cluster called Green STEP (Sustainability Technical Education Program) which encompasses the concepts of sustainability, energy efficiency, renewables, and green building. The relatively new program provides trainings that focus on energy efficiency and renewable energy in the technical fields, particularly construction, HVAC, plumbing, and also apprenticeship-type programs with industry partners. These trainings should include the skills needed for newer job classifications, like solar installers, but also supplemental skills that help to "green" traditional careers. Integrating sustainability as a foundational principle for students preparing to work in the technical and building science fields helps to ensure a stream of trained energy professionals into the future. Industry participation is key to engaging students in these trainings and to providing opportunities for hands-on training

[28] United States Department of Energy. 2017. "U.S. Energy and Employment Report." *https://energy.gov.* January. https://energy.gov/sites/prod/files/2017/01/f34/2017%20US%20Energy%20and%20Jobs%20Report%20State%20Charts%202_0.pdf

and experience. The Green STEP program partnership between Energize Connecticut[SM], the Connecticut Technical High School System, Eversource, the United Illuminating Company, and the Connecticut Business and Industry Association (CBIA) Education & Workforce Partnership is a prime example of industry engagement to connect high school students with energy industry opportunities and experiences.

According to a CBIA Education Foundation and DEEP survey of Connecticut's energy and energy efficiency workforce needs, 94 percent of energy businesses use on-the-job training as the primary means of improving skills of new hires (Figure B11).[29] Apprenticeship programs in manufacturing, healthcare, and business services already exist and could serve as models for such a program, and the CT Dept. of Labor has begun to investigate the possibility of sponsoring an Energy Efficiency Apprenticeship program.

FIGURE B11: Common Strategies Employers Use to Improve Skills of New Hires



Source: Connecticut Business and Industry Association. 2017 Survey of Connecticut Energy and Energy Efficiency Workforce Needs. 2017.

Programs that fill gaps in training for entry-level and new employees in energy-related professions, as well as for those changing to careers in the energy field, are also important. This includes skills needed for energy auditors, analysts, and building automation technicians. As these students often attend courses on a part-time basis, working around job schedules, it is essential that the credentials be stackable allowing them to build on each other over time. Tunxis Community College offers several options for stackable short term certificates and a 2-year degree and in Energy Management (due largely to support from DEEP via U.S. DOE SEP funds). A few other community colleges are providing such trainings, but Connecticut should consider

[29] Connecticut Business and Industry Association. 2017 Survey of Connecticut Energy and Energy Efficiency Workforce Needs. 2017. https://www.cbia.com/wp-content/uploads/2017/06/CT-Energy-Workforce_17.pdf

broadening support for availability of such programs to make them geographically and financially accessible statewide.

Opportunities for Workforce Retraining and Skill Expansion

Additionally, the Energy Workforce Assessment Report identified five energy priority areas that need a well-trained workforce, with energy efficiency and industrial energy management training needs at the top. This plan also identified almost fifty energy related job titles that this industry could potentially incorporate into its business models; including Home Performance with ENERGY STAR inspector, weatherization installer, and more. [30]

There is an opportunity for fuel delivery companies to integrate themselves into the energy efficiency industry through building performance training, expanding business operations to include sales and installation of clean energy, and more. The residential heating fuel oil industry has already begun to diversify and reposition itself with workforce development training programs focused on the energy efficiency industry and over 600 local fuel oil retailers advancing renewable thermal technology like biodiesel distribution through recycled cooking oil collection and bioheat delivery statewide.[31,32]

Just as the fuel oil industry evolved in the early twentieth century out of the ice and coal delivery service as technology advanced, DEEP has great confidence in its ability to adapt into a key player of the clean energy economy.

Energy Efficiency Investment

Focusing on energy efficiency as a primary means for achieving Connecticut's energy goals in the building segment is not a new strategy, but rather a continuation of ongoing efforts statewide. Connecticut's keystone energy efficiency programs, administered since 1999 by the major electric and natural gas companies as a public-private partnership known since 2013 as "Energize Connecticut[SM]," a collaboration of the major utilities (the utility companies), DEEP, the Connecticut Green Bank, and the Connecticut Energy Efficiency Fund (CEEF). The website, EnergizeCT.com,

[30] Burns, Thomas J. 2015. *Connecticut Energy Workforce Assessment: Building the Future Energy Workforce .* Connecticut Department of Energy and Environmental Protection. http://www.ct.gov/deep/lib/deep/energy/cbiaenergyworkforcereport2015finalreport.pdf

[31] Connecticut Energy Marketers Association (CEMA). n.d. *Consumer Information about Oil Heat.* http://www.ctema.com/consumerInfoOilHeat/.

[32] Connecticut Energy Marketers Association. 2016. *Bioheat.* http://www.bioheatnow.com

Energize Connecticut℠ Achievements

Residential Programs Savings:

- $40 million annually
- 180 million kWh annually
- 3 million CCF natural gas annually
- 1.6 million gallons of fuel oil annually
- Over 1 million projects & rebates annually

Commercial & Industrial Savings:

- $38 million annually
- 258 million kWh annually
- 3.9 million CCF natural gas annually
- Spread across 6,500 projects annually
- In 2016, investments generated a nearly $1.4 billion increase in the Gross State Product

serves as a consolidated source of energy information for residents, communities, and businesses.[33]

The programs are developed and described in the Electric and Natural Gas Conservation and Load Management Plan (the C&LM Plan), which is revised every three years, pursuant to Connecticut General Statutes Section 16-245m. The C&LM Plan is implemented by the State's major electric and natural gas distribution companies, Eversource and United Illuminating (Avangrid), and guided by the Connecticut Energy Efficiency Board, a citizens' advisory board. The programs and solutions provided under the Energize Connecticut℠ approach provides a wide range of energy efficiency and energy demand reduction programs for residential, commercial and industrial customers. Connecticut municipal energy cooperatives and companies similarly invest in efficiency for their customers.

DEEP reviews the three-year C&LM Plan, to ensure that investments are equitably distributed across all residential, commercial, and industrial customers across the state. This C&LM Plan for 2016-2018 represents 2.1 billion in benefits over the lives of the installed upgrades. The energy savings will be achieved at a cost of about 4.5 cents per kWh of lifetime electric savings, and less than 50 cents per therm of lifetime natural gas savings— making efficiency less expensive than other energy resources.[34]

Following the recommendation of the 2013 CES, Connecticut increased its commitment to energy efficiency. Public Act 13-298 amended Connecticut General Statutes Section 16-245m(d) to require approval of a budget capable of funding the Electric and Natural Gas Conservation and Load Management plan through a fully reconciling Conservation Adjustment Mechanism (CAM)

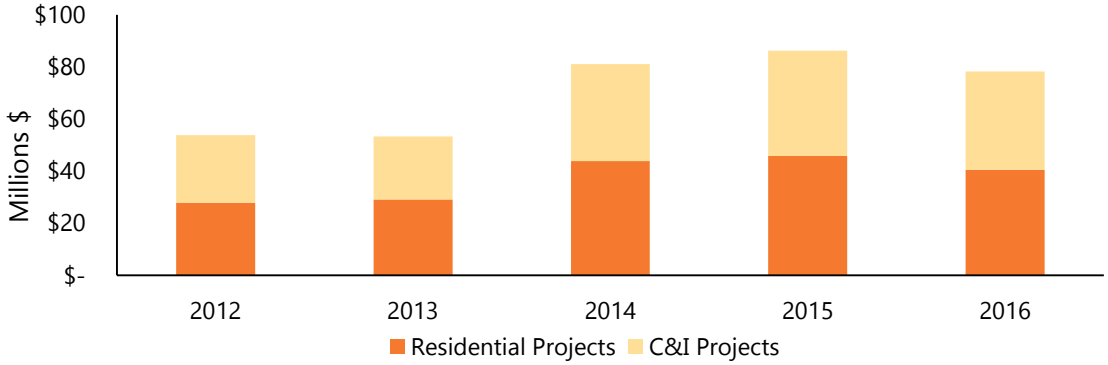
[33] The Companies include the Connecticut Light and Power Company (CL&P) doing business as Eversource Energy (Eversource), The United Illuminating Company (UI), the Connecticut Natural Gas Corporation (CNG), the Southern Connecticut Gas Company (SCG), and Yankee Gas Services Company (Yankee Gas) doing business as Eversource Energy.

[34] Molina, Maggie, "The Best Value for America's Energy Dollar: A National Review of the Cost of Utility Energy Efficiency Programs", Publications, American Council for an Energy-Efficient Economy, 2014, http://aceee.org/research-report/u1402

of $0.003/kWh and $0.046/ccf natural gas supplementing the Connecticut Energy Conservation and Load Management Fund (aka the Connecticut Energy Efficiency Fund or "CEEF"). Subsequently, the increased investments resulted in increased savings (Figure B12).

Increased funding has resulted in greater energy savings statewide. Over 80 percent of the funds collected through the CAM are reinvested back into residential, commercial, and industrial customers' homes and businesses. Since 2013, annual savings have increased by 45 percent, and the total number of projects have increased by 95 percent, allowing greater distribution of benefits statewide.[35] Continuing this investment will be necessary to maintain savings.

FIGURE B12: Annual Statewide Energy Efficiency Fund Projects Total Energy Cost Savings



Source: Connecticut Energy Efficiency Board. "Annual Legislative Reports". www.energizect.com.

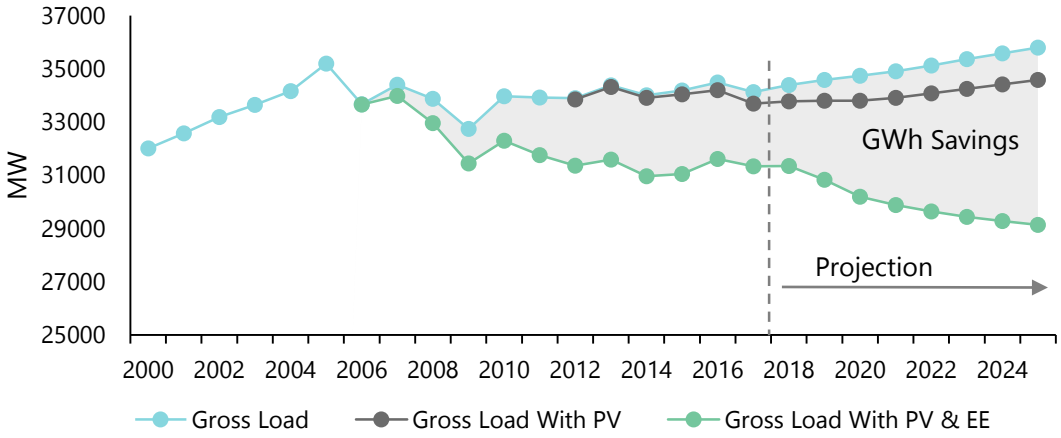
As highlighted in the 2013 CES, a critical next step for the C&LM Plan is to motivate residents and businesses to implement deeper efficiency measures. As deeper measures can be more expensive, programs will need to continue to be refined to suit the needs of different market participants. This will inform the design of energy solution programs to address challenges such as inadequacies in access to capital among different segments, various structural, health and safety barriers, and other challenges unique to each building segment and classification.

ISO New England (ISO-NE) has projected system demand both with (the top blue line) and without energy efficiency (the bottom green line), described in Figure B13. Due to energy efficiency investments, energy demand has begun to flatten, helping to relieve pressure on the grid and minimize peak periods of fuel-intensive power generation. Importantly, over the next ten years, energy efficiency efforts are expected to eliminate growth in peak demand in Connecticut, decreasing it by about 0.4 percent annually as shown in Figure B14.

[35] Connecticut Energy Efficiency Board " Annual Legislative Reports." *www.energizect.com.* https://www.energizect.com/connecticut-energy-efficiency-board/about-energy-efficiency-board/annualreports.

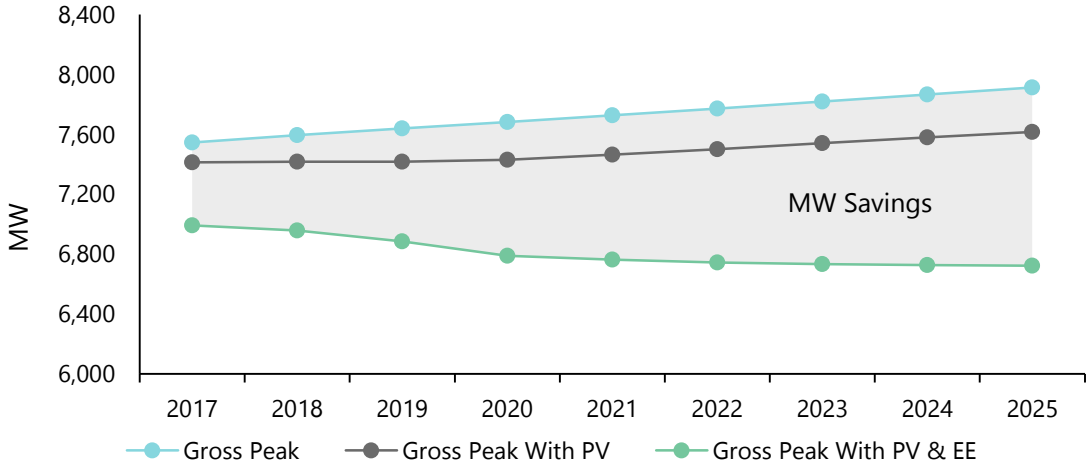
Continuing to reduce peak demand will become even more critical as the transportation sector is electrified to meet Connecticut's Global Warming Solutions Act targets in 2020 and 2050. Similarly, the electrification of heating systems will likely increase load and will need to be controlled, particularly during peak demand periods. Strategies that use buildings as resources to manage peak demand will therefore play an increasingly important role in Connecticut's approach to managing its energy needs.

FIGURE B13: Connecticut Annual Energy Demand With and Without Energy Efficiency (EE) and Solar (PV) Savings



Source: ISO New England, 2017, *2017 Capacity, Energy, Loads, and Transmission (CELT) Report.*

FIGURE B14: Connecticut Forecasted Summer Peak Demand With and Without EE & PV Savings



Source: ISO New England, 2017, *2017 Capacity, Energy, Loads, and Transmission (CELT) Report.*

Connecticut was recently ranked 5th out of all 50 states on the American Council for an Energy Efficiency Economy's (ACEEE) State Energy Efficiency scorecard in 2016 and 6th in 2015.[36] This ranking recognizes the State's commitment to achieving cost-effective energy efficiency goals across all sectors and the state's leadership in treating energy efficiency as a resource equally valuable as other generation sources.

Load Management

Active vs. Passive Demand Response

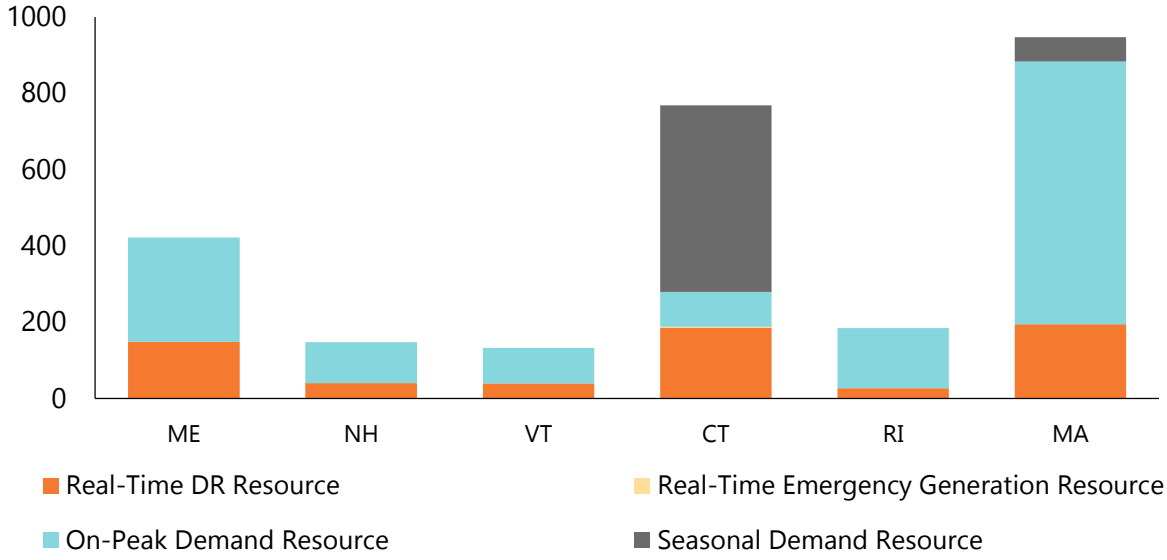
Demand response curtails demand for electricity based on market signals. Passive demand response, more commonly referred to as energy efficiency, enables electricity consumption to be continuously reduced, for example by installing more efficient light bulbs or an energy efficient refrigerator. These strategies reduce demand overall throughout the day. As previously discussed, energy efficiency is the cheapest, and cleanest energy source.

Alternatively, active demand response is used only when peak demand is anticipated to be reached, typically in the middle of the day in the hot summer months when customers receive a signal shortly before the electric grid is about to experience a period of heightened demand and rather than continuously reducing their demand, customers who provide active demand response resources will limit their electricity consumption only during that period. Active demand response can reduce peak demand, and subsequently, overall system costs by preventing a less efficient power plant from needing to generate, benefiting all customers. There are a number of different strategies that can be used to catalyze active demand response under current market conditions, both within the forward capacity market and outside of it.

Though Connecticut actively uses multiple demand response resources to catalyze active demand response under current market conditions as shown in Figure B15, there are two types of active demand response that are best employed by our residential, commercial and industrial buildings– real time demand response and real time emergency generation. Connecticut needs to improve accessibility and usability by buildings of these technologies in order to maximize the potential benefits of demand response.

[36] American Council for an Energy-Efficient Economy, "The State Energy Efficiency Scorecard", 2016, *aceee.org.* http://aceee.org/state-policy/scorecard.

FIGURE B15: Demand Resource Asset Enrolled By Resource Type and Load Zone



Source: ISO New England, 2017. "Demand Resources Working Group."

Customers who provide active demand response through on-site generation do not reduce their electricity consumption but instead turn to standby generation located on their property. By consuming energy from onsite generation, these facilities effectively reduce demand on the electric grid. Increasing renewable generation sources for onsite generation, such as solar, wind, anaerobic digestion, and cleaner generation sources such as fuel cells can enable participation in active demand response programs without turning to diesel generators for standby generation for non-critical and critical infrastructure buildings. Doing so could increase the opportunities for cleaner active demand response participation at such buildings.

Critical facilities, such as hospitals, that have emergency generation are those that need to be able to operate during times of power outages. These emergency generation units are often fueled by diesel which can be stored on site, but as technology advances, facilities could consider less polluting options like hydrogen fuel cells, or renewable and energy storage combinations for use during emergency generation periods.

On a smaller scale, residential buildings can reduce, or even eliminate, their grid load demand by generating their own energy through renewables, particularly solar photovoltaics. The ability for homeowners to put solar panels on their roofs allows them to directly link to the grid and sell back the energy they do not need; yet another way to reduce the load on current generators. Capturing the actual net cost of this demand reduction to ensure that the cost of interconnection and two-way communication from multiple individual homes does not result in shifting system costs to others will be necessary to ensure equitable distribution of system reliability costs.

Past and Current Advanced Meters Upgrades

UI is in the process of replacing its conventional meters with more advanced technology as its metering infrastructure approaches the end of its useful life. This means that UI is better positioned to provide its customers with the opportunity to control their use and costs in the near term by promoting existing time-of-use rate options and developing new dynamic demand-response price options.

In contrast, a 2009 pilot deployment of advanced meters by CL&P (now Eversource) and a proposal to implement advanced metering infrastructure for all customers by 2016 was suspended in 2011 due to concerns that abandoning the current metering system would result in replacement costs of about $300 million and over $100 million of stranded costs.

Onsite Energy Storage

Facilities or homes that can generate their own energy can, at times, find themselves with greater amounts of generated energy than they need. Sending this excess out to the grid is an option, but this leaves the potential for overloading the grid, rendering it unstable.[37] Another option exists in energy storage. If a facility or building uses onsite renewables, storage would allow them to have reliable power if the sun is not shining or the wind is not blowing. If they use backup generation in coincidence with TOU rates, they can cut consumption during a period of peak demand and high energy rates and rely on stored energy.

In 2015, the Massachusetts Department of Energy Resources prepared a study on energy storage. It stated that "the need to size all grid infrastructure to the highest peak results in system inefficiencies, underutilization of assets, and high costs to ratepayers," and "energy storage is the only technology that can use energy generated during low cost off peak periods to serve load during expensive peak periods."[38]

Commercial-scale energy storage costs have declined by over 70 percent since 2010 and are continuing to improve.[39] This technology is still undergoing research and development, but early designs do currently exist in the forms of batteries, flywheels, thermal storage, and pumped hydroelectric storage.[40] These are capable of deploying energy within seconds.

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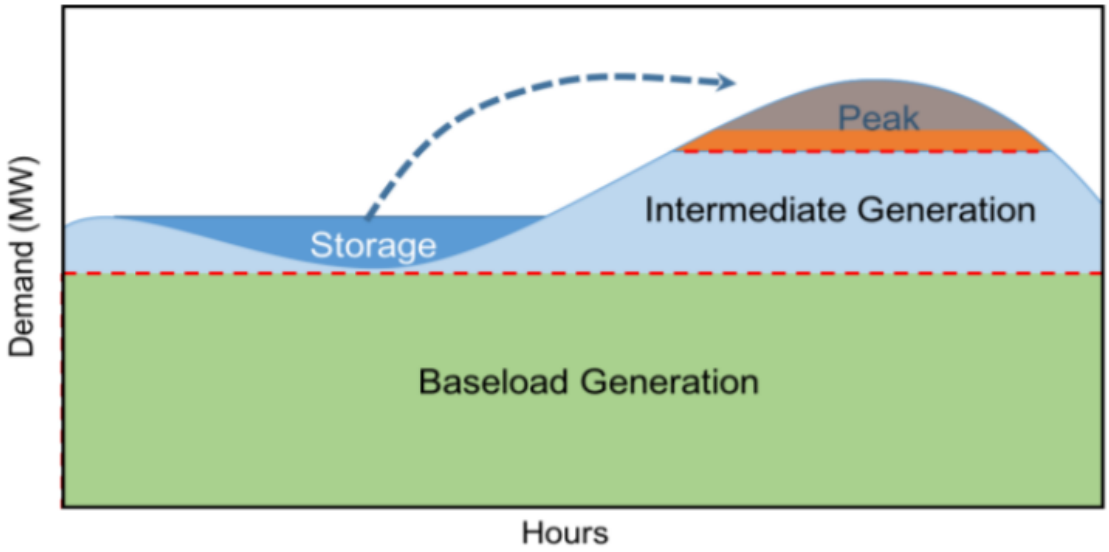
[37] Institute for Energy Research. 2013. *Germany's Green Energy Destabilizing Electric Loads.* 23 January. http://instituteforenergyresearch.org/analysis/germanys-green-energy-destabilizing-electric-grids/#.

[38] Massachusetts Department of Energy Resources. 2015. *Massachusetts Energy Storage Initiative.* Massachusetts Executive Office of energy and Environmental Affairs.

[39] Mckinsey & Company . 2016. *The New Economics of Energy Storage.* August. http://www.mckinsey.com/business-functions/sustainability-and-resource-productivity/our-insights/the-new-economics-of-energy-storage.

[40] Massachusetts Department of Energy Resources. 2015. *Massachusetts Energy Storage Initiative.*

FIGURE 16: How Energy Storage Can Offset Peak Energy during Times of High Demand



Source: Massachusetts Department of Energy Resources. 2015. *Massachusetts Energy Storage Initiative.*

While residential-level storage options are beginning to appear on the market like the Tesla Wallpack, other options include turning electric water heaters and electric vehicles into energy storage devices. Conventional storage water heating typically operates by maintaining the water temperature in the water tank at approximately 120° F. This means that these systems continually demand electricity to maintain this water temperature, with the amount of electricity required highly dependent on how effectively the water tank is insulated. Traditional storage water tanks can be converted into active demand response resources, however, by installing what is called a grid-interactive water heater which enables water to be heated to a higher temperature in advance of when a period of peak demand is predicted to occur. Then, if warm water is needed during the peak, this hotter water can be combined with cooler water to produce water out of the tap at the appropriate temperature without requiring any electricity to heat the water.

Likewise, as Connecticut seeks to electrify its transportation systems, electric vehicle fleets will increase and while they can increase energy demand, they can serve as storage devices. Homes or buildings that utilize onsite generation, whether emergency or general, can store and use excess generation in the batteries of electric vehicles.

Market Transformation Advances

The Value of Energy Efficiency in the Real Estate Market

Multiple studies have found measurable, beneficial impacts of energy efficiency on the residential real estate market. Their findings are summarized below

- **Griffin (2009):** Certified homes in Portland, OR, sold for an average of 4.2 percent more and 18 days faster compared to non-certified.
- **Mosrie (2011):** Green buildings resist downward housing trends and their prices per square foot have steadily increased since 2007
- **Kok, Nils & Kohn (2012):** Home energy efficiency is more valuable at time of sale in extreme climates compared to more mild ones.
- **Springer (2015):** Every $1 of annual energy savings equates to $15-$20 at the time of sale
- **Elevate Energy (2015):** Study on Chicago homes found that homes that disclosed energy costs spent 43 days on the market and a 66 percent closing rate while homes that did not spent 63 days at a 53 percent closing rate.
- **National Association of Realtors (2015):** Energy improvements are investments found to bring "joy" in addition to increased comfort and financial benefits.

Connecticut's tools and opportunities to change the energy future for its residential buildings are numerous and robust. However, they are also complex to the average person. Effective marketing, education, and outreach is key to informing those who decide to install energy efficient measures. They are motivated to do so by classic market drivers like price points, advertising, and interactive programs. Bringing the market to the desired scale will be challenging if the customers do not understand the value of efficiency improvements.

The most effective way to make the value of energy efficiency measures clear to homeowners is to use standardized documentation methods. In 2015 Connecticut became the first state in the nation to fully adopt the use of the U.S. DOE's Home Energy Score in its energy efficiency assessment programs. This program is designed to be a nationally standardized "miles-per-gallon" score of a home's energy efficiency and to make transparent the value of efficiency improvements.[41] Connecticut has completed over 21,000 Home Energy Scores to date.

[41]U.S. Department of Energy . n.d. *Home Energy Score.* https://betterbuildingssolutioncenter.energy.gov/home-energy-score.

The Multiple Listing Service's Integration of Green Fields

The MLS is the primary property listing platform nationwide and provides a swift channel to integrating energy efficiency into real estate sales. The Appraisal Institute's Residential Green and Energy Efficiency Addendum identifies six elements of homes' green features with over 35 fields for data input that can be used in this intention.[42] The National Association of REALTORS® (NAR) and NAR's Green Resource Council Green MLS Implementation Guide outlines actions states can take to identify and technical needs of MLS staff and how to implement the green entry data fields defined by the Real Estate Transaction Standard (RETS) Data Dictionary. It bridges the gap between the Green MLS Tool Kit, which is designed for real estate professionals, and the Data Dictionary, which is used by technology experts. The Green MLS Implementation Guide recommends a set of preliminary actions for public records aggregators to auto-populate fields through data collection from third-party certifications such as LEED for Homes or BPI-2101Standard Requirements for a Certificate of Completion for Whole-House Energy Efficiency upgrades.

Building codes

While cars, appliances and other products can quickly become obsolete, buildings are intended to last into the future. This means that their designs will affect and contribute to Connecticut's energy consumption for decades to come.

Building energy codes are most commonly focused on new buildings but they are also applied to existing buildings, usually during renovations. By adopting current building codes, policy makers can ensure a certain level of expected energy savings, regardless of other programs in operation. It is estimated that between 2008 and 2025, the impacts of existing codes and standards alone can achieve a 3.6 percent to 8.6 percent reduction in building electricity use, nationwide.[43] DOE estimates that energy cost savings for Connecticut resulting from updated building energy codes are on the order of $76 million annually by 2030.[44]

Effective October 1, 2016, Connecticut adopted the 2012 International Energy Conservation Code (IECC). Currently Connecticut is in the process of updating the State Building Code to include the 2015 IECC code. This revision of state regulations is estimated to be completed by 2018. The state

[42] Appraisal Institute . 2013. "Residential Green and Energy Efficient Addendum ." *https://www.appraisalinstitute.org.* January. https://www.appraisalinstitute.org/assets/1/7/AI_820_04-Residential_Green_and_Energy_Effecient_Addendum.pdf.

[43] Rohmund, Ingrid, Anthony Duer, Sharon Yoshida, Jan Borstein, Lisa Wood, and Adam Cooper. 2011. *Assessment of Electricity Savings in the U.S. Achievable through New Appliance/Equipment Efficiency Standards and Building Efficiency Codes (2010-2025).* Institute for Electric Efficiency.

[44] Hogan, Kathleen . "Letter to Governor Malloy: State Certification of Residential and Commercial Building Energy Codes." 2013. 31 May.

will need to continue to regularly revise state building code regulations to ensure adoption of the most current published editions of the model codes.

The 2012 IECC commercial requirements are stricter, compared to the 2009 IECC, with a major change to incorporate an additional efficiency option in a project, and adding a new section for system commissioning. Likewise, the 2015 IECC requirements will be stricter and more specific than the 2012 IECC when they are adopted. They will include equipment and systems that were not covered in previous IECCs, will have options in the building envelope sections that will have lighting system design requirements, and have additional efficiency options.

Optimized building siting and landscaping

There are also environmental actions homeowners can take to improve their thermal efficiency such as strategic tree shading. Trees not only provide privacy and can help slow erosion, but they can provide shade while still allowing for air circulation. This can benefit building occupants particularly during the hot summer months as shading evapotranspiration can reduce air temperature around trees by as much as 6°F. Additionally, since cooler air settles near the ground, the air temperature beneath trees can often be 25°F cooler as compared to an asphalt surface.[45]

Homeowners should both properly maintain trees on their property, and consider planting trees at appropriate distances from their homes. According to the DOE, a six to eight foot deciduous tree planted near a home can begin shading a window within the first year, and many species can provide roof shade within five to 10 years.[46] If there is not sufficient room for a tree to grow on a property without the roots eventually damaging the building's foundation, planting native shrubs and groundcover plants around the home can reduce heat radiation and cool the air before it reaches the building's walls and windows. These practices can help to reduce cooling energy loads.

Renewable Thermal Technologies (RTTs)

Connecticut's large consumption of energy for thermal purposes positions it to significantly benefit from renewable thermal technologies (RTTs), especially air-source heat pumps, ground-source heat pumps, and solar water heating. These technologies harness thermal resources from the sun, air, and ground, allowing them to provide extremely efficient heating and cooling. This also means they offer important means to decrease reliance on fossil fuels and sharply reduce

[45] United States Department of Energy. "Landscaping for Shade." N.d. https://energy.gov/energysaver/landscaping-shade
[46] Id.

residential, commercial, and industrial GHG emissions.[47] [48] This potential—and the need for deep GHG emissions reductions in these sectors to meet the 2050 target required under the Global Warming Solutions Act—means Connecticut needs to more aggressively pursue deployment of RTTs within the building sector.[49]

Whole-Building RTT

A recent analysis performed by Yale University on behalf of the Connecticut Green Bank and the major utility companies found that, given today's energy market conditions (and excluding available rebates), heat pumps and solar water heating generally are cost-effective—have positive "net present value" for the customer—as whole-building substitutes for only a narrow segment of Connecticut's building stock.[50] As shown in Table B2, with fossil fuel prices currently low, RTTs presently are cost-effective as whole-building substitutes only when they replace electric-resistance heating. Replacing electric-resistance units with RTTs would provide a direct return on investment in less than 15 years in most of these contexts and less than 5 years in some.[51] [52]

With today's fuel prices, and excluding available rebates, these RTTs are not yet cost-effective whole-building substitutes for fuel oil and natural gas systems that provide space and water heating in the vast majority of Connecticut's homes and commercial buildings. For most of

[47] Meister Constultants Group . 2015. "Waking the Sleeping Giant: Next Generation Policy Instruments for Renewable Heating & Cooling In Commercial Builidngs (RES-H Next)." *iea-retd.org*. February . http://iea-retd.org/wp-content/uploads/2015/02/RES-H-NEXT.pdf.

[48] International Energy Agency. 2014. "Heating Without Global Warming: Market Developments and Policy Considerations for Renewable Heat." *www.iea.org* . https://www.iea.org/publications/freepublications/publication/FeaturedInsight_HeatingWithoutGlobalWarming_FINAL.pdf.

[49] On the scope of the role of RTTs in meeting the 2050 target for greenhouse gas emissions, see DEEP presentation to Governor's Council on Climate Change, Oct. 19, 2017, http://www.ct.gov/deep/lib/deep/climatechange/gc3/gc3_10_19_17/gc3_meeting_10_19_2017.pdf, slide 14. The council has not yet recommended an appropriate 2030 target for GHG reductions. The pace of RTT deployment required to meet a 2030 target and the 2050 target would depend in part on the pace of deployment of zero-carbon electricity in the regional grid.

[50] This calculation accounted for cost of installing, financing, operating, and maintaining HVAC equipment. It excluded non-energy benefits such as reduced social cost of carbon, improved air quality, and enhanced comfort.

[51] Gronli, Helle, Fairuz Loutfi, Iliana Lazarova, Paul Molta, Prabudh Goel, Philip Picotte, and Tanveer Chawla. 2017. "Feasibility of Renewable Thermal Technologies in Connecticut: Market Potential." Yale University, Center for Business and the Environment, http://cbey.yale.edu/sites/default/files/FORTT_Market%20Potential.pdf.

[52] This study's sensitivity analysis indicated that rebates capable of reducing the initial cost of heat pumps and solar hot water by 25 percent — considerably more than current rebates accomplish — would make these RTTs cost effective as replacements for electric-resistance heating in additional kinds of commercial buildings. However, under the study's assumptions, even these hefty rebates would not make the RTTs cost-effective replacements for fuel oil or natural gas systems in residential or commercial buildings (table 18, p. 76).

Connecticut's residential and commercial buildings, a return on investment in whole-building RTT systems would take longer than 15 years.[53]

TABLE B3: Connecticut Cost-Effectiveness of Whole-Building RTTs as Substitutes for Space Heating and Cooling in a Variety of Building Types

RTT	As Substitute For	Building Type Applicability						
		Single-Family	Apartment Building	School	Restaurant	Hospital	Hotel	Office Building
ASHP space heating & cooling with no ductwork	Electricity	■	■	■	■	■	■	■
	Fuel Oil							
	Natural Gas							
ASHP space heating & cooling with ductwork	Electricity	■	■					
	Fuel Oil							
	Natural Gas							
ASHP water heating	Electricity	■	■	(not evaluated)				
	Fuel Oil							
	Natural Gas							
Ground-source heat pump space heating & cooling	Electricity	■	■	■		■		
	Fuel Oil							
	Natural Gas							
Solar water heating	Electricity	■	■		■	■		
	Fuel Oil							
	Natural Gas							

■ *Cost-effective (NPV≥1) in light of cost to finance, install, operate, and maintain in present market conditions and without accounting for available financial incentives*

Source: Gronli, et al. 2017. "Feasibility of Renewable Thermal Technologies in Connecticut: Market Potential."

Partial-Building RTT

Connecticut should simultaneously promote a particular RTT that is becoming a suitable *partial* substitute for conventional HVAC units in single-family homes. The Yale assessment of RTT market conditions cited above examined only RTTs sized to satisfy 100 percent of buildings' heating loads.[54] This assumption does not reflect the market for a key form of RTT: ductless air-source heat pumps (ASHPs), the RTT that is making the strongest inroads in New England's HVAC market. Ductless air-source heat pumps typically are installed to heat or cool a single room or zone rather than an entire building. A recent study by Cadmus Group—focusing on the cost of operating RTTs—found that these units, and especially versions optimized for cold climates, routinely are cost-effective in single-family homes in Massachusetts and Rhode Island, which have climates and

[53] Gronli, et al. 2017. "Feasibility of Renewable Thermal Technologies in Connecticut: Market Potential."
[54] Id.

energy prices comparable to Connecticut's. Air-source heat pumps were always more cost-effective than both propane and electric-resistance heating, Cadmus found, and air-source heat pumps optimized for cold climates were more cost-effective than oil heating except during periods of extreme cold.[55] [56]

An important consideration here is that in New England about 30 percent of ductless air-source heat pumps are being installed primarily to provide cooling and about 65 percent for both heating and cooling.[57] Especially with annual cooling-degree days and the incidence of extremely hot weather increasing as the region's climate warms, the state should promote awareness that ductless air-source heat pumps can often cost-effectively displace conventional air conditioning in the warm months but also propane heating during the entire heating season and oil heating during significant portions of the heating season.[58] [59]

Availability of Cleaner Fuel Choices

Connecticut is also modifying traditional heating fuels so that they become cleaner. Effective July 1, 2018, the maximum allowable fuel sulfur content in heating oil will be reduced from 500 parts per million (ppm) to 15 ppm.[60] This is expected to lower sulfur dioxide emissions by over 10,000 tons per year.[61] [62] Moving to a fuel oil blend containing 20 percent sustainable biodiesel could reduce lifecycle carbon dioxide emissions and would reduce damage to heating equipment and reduce maintenance costs. Section 16a-21b(b) of the General Statutes lays out a

[55] The Cadmus Group, Inc. 2016. "Ductless Mini-Split Heat Pump Impact Evaluation." December. http://ma-eeac.org/wordpress/wp-content/uploads/Ductless-Mini-Split-Heat-Pump-Impact-Evaluation.pdf.

[56] In 2016, cold-climate ASHPs were more cost-effective than oil heat down to temperatures as low as 26 degrees F.; and especially efficient cold-climate units (HSPF 13) were more cost-effective than oil down to 15 degrees F. The latter units were more cost effective than even natural gas heating down to 28 degrees F. Crucially, this cost-effectiveness is routinely achieved even in the absence of sophisticated control technologies (which are only now emerging) that can maximize customer savings through integrated management of both RTT and conventional fossil-fuel-based HVAC equipment.

[57] The Cadmus Group, Inc. 2016. "Ductless Mini-Split Heat Pump Impact Evaluation." December. http://ma-eeac.org/wordpress/wp-content/uploads/Ductless-Mini-Split-Heat-Pump-Impact-Evaluation.pdf.

[58] National Climate Assessment. U.S. Global Change Research Program. n.d. http://nca2014.globalchange.gov/report/regions/northeast.

[59] DEEP analysis of National Oceanic and Atmospheric Administration data indicates that the number of cooling-degree days in Connecticut has increased about 30 percent since 1905, while the annual number of days with high temperatures over 90°F has trended upward from about 8 to more than 20. The National Climate Assessment predicts that with continued rapid increases in global atmospheric concentrations of greenhouse gases, parts of Connecticut routinely will see 30-40 days per year over 90°F in the middle of the century—on par with the most extreme summers of the 20th century.

[60] Regulations of Connecticut State Agencies §22a-174-19b

[61] Connecticut Department of Energy and Environmental Protection. "*Connecticut Regional Haze State Implementation Plan.*" 2009.

[62] Connecticut Department of Energy and Environmental Protection. "*Connecticut Clean Diesel Plan*". 2006. http://www.ct.gov/deep/lib/deep/air/diesel/docs/ctcleandieselplanfinal.pdf

framework for requiring that over a period of years increasing concentrations of biodiesel be blended into all heating oil sold in Connecticut. However, the law stipulates that the blending requirement would not go into effect until the states surrounding Connecticut having similar requirements. Rhode Island has implemented a blending requirement; New York City has a requirement, but New York State has none; and Massachusetts has a blending requirement but has placed it on indefinite hold.[63] In their 2017 annual report, Connecticut's Distillate Advisory Board reported that their plan is to continue to track the status of blending requirements in surrounding states.

Current cost-effectiveness testing methods.

By informing our understanding of the cost-effectiveness of existing and proposed energy efficiency measures, cost-benefit testing strongly influences energy efficiency programs and the level of incentives Connecticut's energy efficiency and renewable energy programs offer. Improvements in these testing procedures can provide greater transparency of Connecticut's energy efficiency policies and programs. Connecticut's testing procedures need to more fully reflect the state's energy and environmental goals. The emerging "resource value" framework is an approach that could be employed to evaluate the effectiveness not just of energy efficiency as a supply resource but ultimately other energy sources as well.

Connecticut currently uses the Utility Cost Test, supplemented with the Modified Utility Cost Test and Total Resource Cost Test. Nationally, reforms in cost-benefit testing have been initiated by numerous regulated utilities in the Northeast as well as development of a new conceptual framework in the *National Standard Practice Manual* issued by the National Efficiency Screening Project in early 2017.[64] DEEP expects to continue assessing the various approaches other states have developed and will provide direction to the Energy Efficiency Board and the utility companies prior to the development of the next three–year C&LM Plan.

The *National Standard Practice Manual* outlines a framework for identifying state policy goals that should inform testing; and identifies universal principles such as transparency, and symmetry in accounting for costs and benefits. DEEP can work with the utility companies, the Energy Efficiency Board, and stakeholders to monitor regional and nationwide developments and review the utility

[63] Connecticut Department of Consumer Protection. "Report…Regarding the Work of the Distillate Advisory Board [per CGS 16a-21b(g)]." 2017.
[64] National Efficiency Screening Project, National Standard Practice Manual for Assessing Cost-Effectiveness *of Energy Efficiency Resources,* 2017, https://nationalefficiencyscreening.org/national-standard-practice-manual/.

companies' cost-benefit testing procedures for opportunities to incorporate best additional practices.[65]

Combined heat and power (CHP)

Combined heat and power (CHP), also known as cogeneration, works by capturing excess heat from generation and processes and using that to heat a facility. CHP has been used in the United States over 100 years but currently only account for approximately 8 percent of capacity whereas in other countries use it at the level of 30 percent or greater. There are several forms of commercially available CHP technologies, including gas turbines, micro-turbines, steam turbines, and hydrogen fuel cells. Encouraging their use achieves multiple policy objectives by reducing energy waste and encouraging distributed generation.

Energy waste at water and wastewater treatment facilities.

There are about 90 water and wastewater treatment plants in Connecticut that process both surface and subsurface wastewater, and potable water.[66] Managing energy waste at these plants poses a unique opportunity for Connecticut's municipalities, water companies, and large manufacturers to cut energy costs and achieve GHG emissions and pollution reduction goals. According to the U.S. EPA, wastewater and water systems use three to four percent of the total energy used nationally, and produce over 45 million tons of GHGs annually. These facilities operate 24 hours a day, seven days a week, and use many energy-intensive components such as pumps and motors. It is estimated that a 10 percent reduction in the energy used by these facilities nationwide could save about $400 million, or 5 billion kWh, annually.[67]

Connecticut's Water Planning Council (DEEP, DPH, PURA, OPM) identified 17 requirements for the 2017 State Water Plan, including "[establishing] conservation guidelines/incentives for water conservation with energy efficiency consideration."[68] Improving the efficiency and conservation efforts in Connecticut's water infrastructure. The U.S. EPA outlines specific recommendations for each component of the water treatment cycle for improving efficiency and reducing energy needs.

[65] This effort began with a regional cost-effectiveness screening workshop sponsored by the Northeast Energy Efficiency Partnerships and the CT Energy Efficiency Board and hosted by DEEP in June 2017. It is expected to continue with a state-level review throughout 2017, with the potential for revisions to the current Conservation and Load Management Plan in fall 2017, or for the next three-year plan in 2018.

[66] United States Environmental Protection Agency. n.d. *Connecticut Final Individual NPDES Permits.* https://www3.epa.gov/region1/npdes/permits_listing_ct.html

[67] United States Environmental Protection Agency . 2013. *Energy Efficiency in Water and Wastewater Facilities .* United States Environmental Protection Agency.

[68] NEIWPCC, Connecticut DEEP, DPH, OPM, and PURA. "*2017 Connecticut State Water Plan".* 2017. http://www.ct.gov/water/lib/water/executive_summary.pdf

These improvements have the potential not only to reduce energy waste and energy costs, but extend the life of the equipment, support economic growth, protect public health, and demonstrate community leadership.

Energy and Water Utility Collaboration

In 2014 and 2015, the utility companies collaborated with the US EPA to discuss best practices of bringing energy efficiency to wastewater and water treatment facilities in Connecticut and overcoming barriers and prioritized this critical infrastructure for focused investment through the C&LM Plan.[69] DEEP supports the continued use of these targeted strategies for the increased implementation of wastewater and water treatment facility energy efficiency upgrades in Connecticut.

In 2016 the utility companies, two municipalities (Waterbury and Milford), and DEEP joined a three-year effort known as the Sustainable Wastewater Infrastructure of the Future (SWIFT) U.S. DOE Accelerator.[70] This focused collaboration will catalyze the adoption of best practices in energy data management, efficient technologies, and financing for infrastructure improvement. Participating partners across the nation, including these in Connecticut, commit to improving the energy efficiency of their facilities by at least 30 percent and integrate at least one resource recovery measure, such as an anaerobic digester, into their facility's energy management plan. DEEP will work to share these learnings with water companies and wastewater treatment facilities.

Guided by Public Act 13-78 and the State Water Plan, water companies can pursue upgrades and improvements that increase efficiency and conservation of both energy and water.[71] Public Act 13-78 expanded the list of eligible projects to include efficiency equipment.

Outlook for Future Demand Management

Connecticut has been a leader in energy efficiency policy and deployment as it advances towards its ambitious energy and greenhouse gas emissions reductions goals. The building sector in particular presents significant opportunity for energy savings and permanent grid load reductions as more and more residents and businesses recognize the value of energy efficiency.

Measuring demand load reductions will need to consider metrics that account for the permanence of market transformations such as efficient building codes, product efficiency standards, and high efficiency lighting, while recognizing the potential for future technological improvements in

[69] Eversource Energy; The United Illuminating Company; Connecticut Natural Gas Corporation; The Southern Connecticut Gas Company. 2015. *2016-2018 Electric and Natural Gas Conservation & Load Management Plan.*

[70] https://betterbuildingsinitiative.energy.gov/accelerators/wastewater-infrastructure

[71] Public Act 13-78 https://www.cga.ct.gov/2013/SUM/2013SUM00078-R02SB-00807-SUM.htm

building and lighting controls that will be needed to offset future demand as the transportation sector is electrified.

Energy efficiency not only helps Connecticut achieve its policy goals, but provides a wide spectrum of benefits to its residents and businesses. These benefits range from cost savings, to health and safety improvements, to permanent regional grid load relief. Even with Connecticut's incredibly diverse housing and building stock and wide variety of businesses, there are thermal, electric, and/or industrial processes opportunities for everyone to save money and energy. The growing energy efficiency industry produces local jobs with a range of skill levels.

Connecticut has consistently increased its commitments to passive demand response through energy efficiency in recent years, and should continue that trend as well as continuing to expand active demand response and demand management programs. Ensuring the interoperability of demand response communications between the electric grid and buildings will require disciplined attention to international standards.

The future of energy demand management will require continuing and expanding investments in energy efficiency, including direct procurement of efficiency as a resource, while also increasing investments in strategies such as strategic electrification, electric vehicle-ready buildings, deployment of advanced meters, and expanded implementation of distribution level demand response. The use of building asset scores, as well as the broadening use of dynamic pricing in time varying rates, critical peak pricing, and peak demand rebates will increasingly need to be used to send economic signals regarding the value of energy to residents and businesses. As Connecticut builds on its approach to buildings as an efficient energy resource and recognizes that energy productivity increases the competitiveness of our businesses, our energy infrastructure will become cleaner, stronger, and more resilient.

PROGRESS OF THE 2013 CES RECOMMENDATIONS

1. Provide sufficient and consistent long-term funding for efficiency programs	
Recommendation Summary: **In order to capture the energy efficiency gains in buildings, the 2013 CES recommended increasing the funding for electric energy efficiency programs to $206 million, and natural gas efficiency to $75 million annually over the coming years. It also recommended that the State ensure that energy efficiency programs address "all fuels."**	**Key Achievements and Ongoing Plans:** • **2013:** Public Act 13-298 established fully reconciling Conservation Adjustment Mechanism (CAM) of $0.003/kWh and $0.046/ccf natural gas effectively increasing the 2014 Energy Efficiency Fund by 47 percent over 2013, bringing the total to $223.5 million. Programs amended to allow participation regardless of fuel type.
2. Revamp existing efficiency fund programs to ensure maximum impact for each ratepayer dollar spent	
Recommendation Summary **Existing and new efficiency programs should be evaluated using consistent metrics that drive innovation to reduce costs, spur participation, and extend the reach of the efficiency investments undertaken. Incentives should be continually reviewed and adjusted to provide the minimal incentive necessary to overcome barriers to participation. Additionally, private capital should be leveraged to support ratepayer funds.**	**Key Achievements and Ongoing Plans:** • **2013-PRESENT:** Programs were updated and customized to reflect customer segmentation. Energize Connecticut℠ message and webpage are implemented to simplify and spur participation. Evaluation of incentives is ongoing. Increased statewide participation leverages increased use of private capital to complete deeper efficiency measures like insulation and efficient HVAC.
3. Develop financing programs to make residential clean energy investments more affordable	
Recommendation Summary: **The State should explore financing tools such as "on-bill" financing, low or no interest rate loan programs, and "with the Meter" debt obligation in order to relieve some financing burdens and barriers to participation in energy efficiency.**	**Key Achievements and Ongoing Plans:** • **2014-PRESENT:** Several Financing elements have been implemented, including: The utility companies begin offering Energize Connecticut℠ Heating Loan, providing low or no interest financing for heating equipment, with electric bill repayment history serving as the only form of qualification. The utility companies also begin offering on-bill repayment, low or no-interest financing for small businesses. CHIF (now d.b.a. Capital4Change) began offering financing products for certain residential segments based on income levels and credit scores. Connecticut Green Bank offers Smart-E Loan with no money down and low interest rates for a large variety of residential energy improvements.

4. Establish commercial property assessed clean energy districts in municipalities across the state	
Recommendation Summary: **Municipalities should work with the Green Bank to pass resolutions through their legislative bodies that will enable their business and commercial residential property owners to access CPACE. Additionally, the General Assembly should consider authorizing municipalities to provide property tax exemptions for increased value of properties resulting from clean and/or efficient upgrades.**	**Key Achievements and Ongoing Plans:** • **2016:** The Connecticut Green Bank released its most current C-PACE guidelines which updated the eligibility requirements for participation, creating a provision for multifamily properties of five or more units. An opt-in statewide program for municipalities became available provided that the interested municipality passes a resolution through their legislative body and enters into a Legal Agreement with the Green Bank.
5. Develop programs to address health and safety pre-weatherization measures	
Recommendation Summary: **DEEP should work with the EEB, the utility companies, and low income advocates to develop remediation of "pre-weatherization" barriers so that owners of older housing units are able to participate in the State's energy efficiency programs.**	**Key Achievements and Ongoing Plans:** • **2015:** The utility companies began tracking occurrence and type of barriered homes during Home Energy Solutions assessments. • **2016:** The utility companies kick off Clean Energy Healthy Homes Initiative (CEHHI) barrier remediation program with $1.5 million fund and a soft cap of $10,000 per project • **2017:** DEEP and CGB participated in US DOE Clean Energy for Low Income Communities Accelerator to identify other sources of funding for barrier remediation (among other topics). DEEP, the EEB, and CGB will continue to seek financing solutions for remediation.
6. Incorporate energy efficiency measures into upgrades of state-administered housing	
Recommendation Summary: **DEEP, CEEF and the Green Bank will work to enforce energy efficiency standards in conjunction with Section 8 Housing Quality Standards to ensure that building occupants are afforded a higher quality living environment and can save money on energy costs.**	**Key Achievements and Ongoing Plans:** • **2013:** DECD received $5 million in Energy Conservation Loan Program funds, budgeted $30 million in state bond financing to assist public housing agencies to bring their residents energy improvements, established that all new units must meeting state building and energy codes, and includes "green" buildings in the growth criteria for its Responsible Growth, Livability Initiatives, and Community Impact goals.
7. Improve existing means-tested energy assistance programs	
Recommendation Summary: **Consideration should be given to modifying the Matching Payment Program for low income utility customers to build on its best attributes and improving the program overall.**	**Key Achievements and Ongoing Plans:** • **2013-PRESENT:** In collaboration with the Low Income Energy Advisory Board, the utility companies work to continuously improve the matching payment plan and other energy assistance programs.

<table>
<tr><td colspan="2">8. Target funding to address split incentives</td></tr>
<tr><td>Recommendation Summary:
DEEP will work to develop tools that promote efficient and/or clean energy improvements in multifamily properties while equitably managing the split of benefits between the owners and tenants. Such incentives could be tied to implementation of a set level of efficiency and may require some level of owner contribution and limits on raising rents</td><td>Key Achievements and Ongoing Plans:
• 2014: CT Green Bank, DEEP, CT Dept. of Housing, CHFA and the utility companies initiate partnership to increase coordination
CHFA and CT Green Bank announced 5 property multifamily energy efficiency pilot
• 2015: Interagency working group completed continuous improvement Lean process and capitalized on $300 million capital plan opportunity through the Governor. The utility companies modified participation agreements to increase predictability earlier in project developments
• 2016: Multifamily Partnership initiative program launched and Green Bank hired consultant to benchmark properties
EEB evaluation administrator completed R157 Multifamily Initiative Process Evaluation to assess if the initiative was functioning properly and found landlords were overall highly satisfied with the program.
• 2017: 43 loans closed to date at $18.4 million with lifetime savings of more than 69 million kWh and 8 million CCF natural gas</td></tr>
<tr><td colspan="2">9. Expand outreach and financing options for businesses in low-income communities to achieve energy efficiency</td></tr>
<tr><td>Recommendation Summary:
Coordinate programs with the Office of Energy Efficient Business, the Connecticut Center for Advanced Technology, and Operation Fuel to ensure that small, largely-minority owned businesses in urban centers have access to energy efficiency opportunities that can economically benefit them.</td><td>Key Achievements and Ongoing Plans:
• 2013-Present: Office of Energy Efficient Business
DEEP and the utility companies provide a consolidated information source for businesses at EnergizeCT.com, and, in partnership with the Connecticut Center for Advanced Technology, Operation Fuel, and the Connecticut Green Bank, administer targeted outreach initiatives that provide individualized education regarding energy billing, explain available energy reduction programs, and conduct basic energy audits at small businesses in targeted communities, including distressed communities.</td></tr>
<tr><td colspan="2">10. implement decoupling to align natural gas utility incentives with energy efficiency</td></tr>
<tr><td>Recommendation Summary:
Public Act 07-242 decoupled electric revenues from volume of sales, but no decoupling mechanism was implemented for the natural gas utilities. Flip the incentive to separate the utility companies' revenues</td><td>Key Achievements and Ongoing Plans
• Electric Decoupling completed
• Natural Gas Decoupling underway</td></tr>
</table>

from their sales by volume, so as to remove the disincentive for them to promote efficiency. This should be accomplished through performance incentives or a performance-based return on equity.	
11. Adopt and enforce latest codes and standards to ensure high-performing buildings	
Recommendation Summary: **The State must adopt and enforce the latest International Energy Conservation Code for residential buildings and the American Society of Heating, Refrigerating and Air Conditioning Engineers Standard 90.1 for commercial buildings as required by statute. Additionally the state should work to provide adequate training to local building inspectors on a regular basis to ensure uniform enforcement statewide.**	**Key Achievements and Ongoing Plans:** **2016-2017:** Effective Oct. 1, 2016 Connecticut adopted the 2012 International Energy Conservation Code (IECC) and is in the process of adopting the 2015 IECC.
12. Work with regional organizations to support stricter federal product efficiency standards	
Recommendation Summary: **DEEP will take a more active role within the Northeast Energy Efficiency Partnership's role in reviewing proposed Federal standards for recommendation of the strictest practical standards**	**Key Achievements and Ongoing Plans:** • **2017:** Connecticut reaffirmed its partnership and support of the Northeast Energy Efficiency Partnerships in January 2017 by providing funding and research advocacy across a range of energy topics including product efficiency standards.
13. Empower consumers with information about efficiency benefits	
Recommendation Summary: **Residential marketing efforts should focus on increasing awareness about the Home energy Solutions program, engaging home performance contractors, available programs and contractor networks, low cost financing, and the benefits of these services, towards homeowners, landlords, and tenants to inform them about the relative efficiency of their home and opportunities to improve it.**	**Key Achievements and Ongoing Plans:** • **2013-2015:** 2013-2015 C&LM Plan outlined multiple push/pull marketing mechanisms for residential programs • **2015:** 2016-2018 C&LM Plan is released and outlines both marketing strategies and contractor training, education, and outreach programs relevant to residential projects. • **2016:** The utility companies and CT Green Bank launch comprehensive and enhanced marketing program to drive performance of residential energy programs and increase their uptake.
14. Train professionals on code compliance and efficient building design and constructions	
Recommendation Summary: **The Strategy supports continued funding of educational and training efforts and collaboration with higher education institutions and regional organizations to ensure building code training is comprehensive and widely distributed.**	**Key Achievements and Ongoing Plans:** • **2013:** 2013-2015 C&LM Plan outlined strategies for increasing energy workforce development. • **2015:** Governor declared October 12-18 as Careers in Energy Week and collaborated with Connecticut Energy Workforce Consortium

	• **2015:** DEEP completed Clean Energy Workforce Assessment to inventory training programs and identify gaps in availability of training and certification • **2016:** The Utility companies implemented 2016-2018 C&LM Plan outlining workforce development strategies for technical high schools, and technical and professional training
15. Empower building owners to market their energy efficiency improvements	
Recommendation Summary: **The Strategy recommends the development and use of a residential building energy use labeling program on a voluntary, pilot basis to help buyers make informed decisions and reward homeowners that invest in efficiency. Additionally, legislation should be considered that requires landlords to provide energy cost data to tenants in units where the tenant pays the energy bill. An energy performance label for both residential and commercial buildings should also be adopted.**	**Key Achievements and Ongoing Plans:** • **2015:** Connecticut became a partnering state in the Northeast Energy Efficiency Partnerships' Home Energy Labeling Information Exchange (HELIX) program. This three year process will result in a platform that allows the exchange of energy data generated through efficiency projects to be used in the real estate market. • **2016:** Continued work on HELIX program and teams with CT Green Bank to begin delivering education and outreach to local realtor associations and the MLSs. CT became the first state to implement the Department of Energy's Home Energy Score labeling system on a statewide voluntary basis through the utility HES and HES-IE programs. • **2017:** NEEP released RFP to begin design phase of HELIX. Connecticut surpassed 21,000 DOE Home Energy Scores