

**APPENDIX C**  
**ENERGY EFFICIENCY**

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## **OVERVIEW**

This Appendix provides background on Connecticut’s forecasted energy efficiency programs and activities and a description of related revenue, budgets, and savings for 2014 through 2024. Utility ratepayer-funded programs and budgets are the primary focus, however other policy approaches to reduce energy waste and achieve greater energy savings are also discussed. The Connecticut Department of Energy and Environmental Protection (DEEP) recommends continued investment in energy efficiency to maintain a critical offset to load growth resulting from economic activity. In recent years, had Connecticut not increased investments in energy efficiency the state would have experienced less control over load growth. As the state experiences increased economic activity, the value and role of efficiency as a load control strategy will increase and the state must be prepared to ensure that efficiency is achieved to ensure that we reduce energy waste and ensure conservation of natural resources, while also providing for a sustainable energy future.

## **BACKGROUND**

### **History of Utility Ratepayer-Funded Energy Efficiency in Connecticut**

Pursuant to Section 33 of Public Act 98-28, *An Act Concerning Electric Restructuring*, the State's electric distribution companies began preparing and implementing annual energy Conservation and Load Management (C&LM) Plans. Between 1998 and 2011, the former Department of Public Utility Control approved the annual gas and electric C&LM Plans. In 2011, Connecticut Public Act 11-80, *An Act Concerning the Establishment of the Department of Energy and Environmental Protection and Planning for Connecticut’s Energy Future*, created a new Department of Energy and Environmental Protection (DEEP); established a new Bureau of Energy and Technology Policy (BETP) within DEEP; and reorganized the former Department of Public Utility Control (DPUC) within DEEP and renamed it the Public Utilities Regulatory Authority (PURA). Connecticut Public Act 11-80 reassigned to DEEP the authority to review, approve, modify, or reject the electric C&LM Plan, and retained with PURA — as the successor agency of the DPUC — jurisdiction to review, approve, modify, or reject the gas C&LM plan. This Act allowed Connecticut to align its energy efficiency goals with national goals and objectives and to work toward positioning Connecticut as a leader in the nation for energy efficiency.

In 2013, Connecticut Public Act 13-298 made additional changes to increase the state’s energy efficiency efforts. Changes included multi-year conservation plans and budgets, the consolidation of natural gas and electric program planning and approval with DEEP, and the ability to increase natural gas and electric conservation spending. Subsequently, the companies submitted, and DEEP approved on October 31, 2013, the 2013-2015 Electric and Natural Gas C&LM Plan.

The C&LM Plan annual electric conservation budget increased from \$100 million to approximately \$180 million with the approval of the multi-year plan. Section 16 of Connecticut Public Act 13-298 states that, to the extent that the DEEP-approved C&LM budget exceeds the revenues collected from the existing three mill “conservation and load” charge per kilowatt-hour PURA shall “ensure that the balance of revenues required to fund such budget is provided through a fully reconciling conservation adjustment mechanism of not more than three mills per

kilowatt-hour of electricity sold to each end use customer of an electric distribution company during the three years of any Conservation and Load Management Plan.” Budgets, programs and energy savings associated with the three-year plan are discussed below.

### **The Benefits of Multi-Year Planning**

As a result of Connecticut Public Act 13-298, Connecticut DEEP approved the first three-year Electric and Natural Gas Conservation and Load Management Plan and budget in 2013. Multi-year planning allows program administrators greater flexibility in program development and implementation and provides stakeholders budget certainty, which encourages program continuity. Program delivery under a multi-year plan reflects expansion and improvement of the EDCs’ existing program structures and designs within state approved program budgets. Multi-year plans allow program administrators time to revise and modify programs to increase cost-effectiveness and energy savings.

### **Non-Utility Ratepayer-Funded Energy Efficiency**

Recently, and particularly in the last two years, the state has committed to a substantial expansion of utility ratepayer-funded energy efficiency programs. Yet utility ratepayer-funded programs are not the only source of increased energy savings. Various state and federal laws and plans<sup>1</sup> also incorporate energy savings as goals to be achieved through strategies designed to advance climate change action, comprehensive energy policy, and sustainable materials management. A diverse array of energy waste reduction programs contribute to energy savings, with a broad framework of state policy objectives driving such gains. For example, the implementation of state and federal laws, including state sustainable materials management and climate change plans, reinforces resource conservation improvements in the manufacturing sector. These plans focus on reducing wasted water, oil, and other materials. This results in reduced energy demand as well as reduced greenhouse gas emissions. Additional reductions in energy consumption are achieving energy demand reductions, including the federal weatherization assistance program, other commercial and residential sector federal and state energy efficiency programs, improved building and product efficiency standards, and increased financing availability.

Therefore, while the Department is currently focused on successful implementation and monitoring of programs under the existing and recently-approved increased funding of utility ratepayer-funded CL&M programs, DEEP is also advancing multiple non-utility ratepayer-funded efforts to reduce energy waste statewide, advance the weatherization of residential properties, and to ensure that demand reduction and energy efficiency is an effective Resource Strategy. These additional efficiency gains are not easily or fully captured in estimates of future contributions of energy efficiency as a Resource Strategy. Therefore, the bulk of the estimates used in this IRP rely on estimates associated with the ratepayer-funded CL&M programs.

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<sup>1</sup> For example, refer to CT’s Climate Change Action Plan, Connecticut’s Solid Waste Management Plan ([www.ct.gov/deep/swmp](http://www.ct.gov/deep/swmp)), US Environmental Protection Agency’s Resource Conservation and Recovery Act, US EPA Roadmap for Incorporating Energy Efficiency/Renewable Energy Policies and Programs into State and Tribal Implementation Plans, <http://epa.gov/airquality/eere/pdfs/EEREmannual.pdf> US EPA Sustainable Materials Management: The Road Ahead: <http://www.epa.gov/wastes/conserve/smm/pdf/vision2.pdf>.

## **Program Descriptions**

Connecticut's energy efficiency implementation strategies address the residential, commercial, industrial, institutional, and governmental sectors, including but not limited to:<sup>2</sup>

### Residential Programs:

- Home Energy Solutions for existing homes and the Residential New Construction program-provide whole house retrofit services with a number of consumer incentives as well as options to builders and/or home owners to incorporate energy efficiency technologies in new construction.
- Upstream price negotiations for retail products help mainstream energy efficient products to enable Connecticut's residents to purchase energy efficiency products at lower prices, while also ensuring efficient products are kept stocked at retailers and distributors.
- Instant discounts and rebates to purchase Energy Star products-for heating, cooling, appliances, electronics and hot water heaters.
- A variety of financing programs offered including the Residential Energy Efficiency Financing Program and the Connecticut Green Bank's Smart-E, Cozy Home, and multifamily loan programs.

### Commercial and Industrial Programs:

- Energy Conscious Blueprint-provides incentives to offset the incremental cost of commercial and industrial new construction/equipment projects, so that customers can implement high efficiency options rather than baseline technologies. Subsequently, creating a more energy efficient building stock in Connecticut and minimizing lost opportunities.
- Energy Opportunities Program-provides incentives and financing to replace existing inefficient equipment with more energy-saving options.
- Process Re-engineering for Increased Manufacturing Efficiency (PRIME)-teaches manufacturing and industrial customers with a minimum annual electricity usage of 500,000kWh methods to increase their productivity, reduce waste, and reduce operating inefficiency while saving energy.
- Business Sustainability Challenge participants integrate environmental management systems and energy conservation and efficiency efforts to improve sustainability and advance strategic energy management by commercial and industrial energy customers.
- Small Business Energy Advantage-provides interest free financing for upgrades to technologies, lighting, refrigeration, motor controls and natural gas efficiency for both commercial and government sector customers.
- The Connecticut Green Bank's Commercial Property Assessed Clean Energy (C-PACE) program-provides financing to commercial, industrial, and multifamily property owners for energy efficiency upgrades and clean energy improvements. Subsequently, owners repay the loan via an assessment on their property bill. The capital provided is secured by a lien on the property.

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<sup>2</sup> The 2013-2015 C&LM Plan Final Decision contains a more detailed description of programs. See C&LM Final Decision, available under "Public Act 11-80 – Section 33-2013-2015 Conservation and Load Management Plan" at <http://www.ct.gov/deep/energyfilings>.

Government Initiatives:

- Lead by Example Program- focuses on reducing energy in state and municipal buildings. This program has developed initiatives to reduce energy use in state and municipal buildings including: (1) energy equipment retrofits in state buildings using bond funds, and (2) small energy savings projects through the utilities' Small Business programs and large projects with multiple energy savings measures at state and municipal buildings through the State's standardized Energy Savings Performance Contracting Program, and (3) procurement of energy efficient electronic equipment.
- Energy Performance Savings Contracting-provides for state agencies and municipalities to implement multi-million dollar retrofit projects with financing provided through guaranteed energy savings.
- Loan Programs-provide funds for items not reimbursed by incentives.
- Federal and State Weatherization Assistance for Low Income Residents

**ENERGY EFFICIENCY BASE CASE: BUDGETS AND ENERGY SAVINGS**

As described in the Main Report, the IRP's Base Case represents a foundational 10-year electricity outlook through 2024. Projections begin with the "known and knowable" about today and the near future, based on publicly available data about electricity markets in Connecticut and the rest of New England. For Connecticut energy efficiency, the IRP first relies on approved Conservation and Load Management (C&LM) plans through 2015. For 2013-2015 DEEP approved annual electric Conservation and Load Management (C&LM) budgets of approximately \$180 million each year and estimates annual funding from the following sources:

- 0.3 ¢/kWh charge on customer bills provided for in Connecticut General Statutes §16-245m;
- Recovery Revenue of up to \$0.003/KWh minus gross earnings tax from a conservation adjustment mechanism (CAM) as authorized by Public Act 13-298.;
- Revenues received from ISO-NE for Other Demand Response;
- Revenues received from ISO-NE for energy efficiency capacity entered into ISO-NE's Forward Capacity Market; and
- Revenues from the Regional Greenhouse Gas Initiative (RGGI).
- Figure 1 shows the funding sources of approved Electric Distribution Companies C&LM budgets for each year, 2013, 2014, and 2015.

2014 INTEGRATED RESOURCES PLAN FOR CONNECTICUT  
Connecticut Department of Energy & Environmental Protection

**Figure 1**  
**Summary of Utility Conservation and Load Management Program (Electric) Revenue Sources**

CL&P/UI C&LM Revenues - 2013 through 2015									
	2013			2014			2015		
	CL&P	UI	Combined CL&P/UI	CL&P	UI	Combined CL&P/UI	CL&P	UI	Combined CL&P/UI
\$0.003/kWh <sup>1</sup>	\$66,713,000	\$16,515,000	\$83,228,000	\$67,071,000	\$15,825,000	\$82,896,000	\$67,014,000	\$15,558,000	\$82,572,000
ISO ODRs	\$3,400,000	\$1,700,000	\$5,100,000	\$3,400,000	\$2,300,000	\$5,700,000	\$3,000,000	\$2,800,000	\$5,800,000
ISO Fwd. Cap.	\$7,623,000	\$0	\$7,623,000	\$8,000,000	\$0	\$8,000,000	\$9,000,000	\$0	\$9,000,000
Class III RECs	\$2,188,000	\$850,000	\$3,038,000	\$0	\$0	\$0	\$0	\$0	\$0
RGGI <sup>2</sup>	\$9,735,000	\$2,234,000	\$11,969,000	\$4,000,000	\$1,000,000	\$5,000,000	\$4,000,000	\$1,000,000	\$5,000,000
CAM C&LM Program Revenue <sup>3</sup>	<u>\$62,494,614</u>	<u>\$15,470,726</u>	<u>\$77,965,340</u>	<u>\$62,829,977</u>	<u>\$14,824,356</u>	<u>\$77,654,333</u>	<u>\$62,776,581</u>	<u>\$14,574,239</u>	<u>\$77,350,820</u>
Total C&LM Program Revenue	\$152,153,614	\$36,769,726	\$188,923,340	\$145,300,977	\$33,949,356	\$179,250,333	\$145,790,581	\$33,932,239	\$179,722,820
Approved EDC C&LM Budget			<u>\$182,904,324</u>			<u>\$178,391,723</u>			<u>\$178,887,455</u>
Revenue Over/(Under) Budget			\$6,019,015			\$858,610			\$835,365

<sup>1</sup> Three mill charge  
<sup>2</sup> RGGI revenue may increase in 2013 and 2015  
<sup>3</sup> CAM revenue recovery @ \$0.003/kWh less gross earnings tax

**Source:** Connecticut Department of Energy and Environmental Protection: Final Decision, 2013-2015 Electric and Natural Gas Conservation and Load Management Plan (October 31, 2013) available under “Public Act 11-80-Section 33-2013-2015 Conservation and Load Management Plan” at <http://www.ct.gov/deep/energyfilings>.

## ENERGY SAVINGS

The Base Case energy efficiency programs are expected to reduce energy consumption by 290 GWh per year, on average, in the 2014 and 2024 time frames (Figure 2). As a result of continuous implementation of energy efficiency programs over the study period, the cumulative annual energy savings (starting in 2014) are expected to reach 3,194 GWh in 2024. These programs are also expected to yield 38 MW of annual capacity savings on average, in the 2014 through 2024 timeframe. Cumulative annual capacity savings are expected to reach between 309 to 413 MW in 2024. Figure 2 presents further detail on energy efficiency program savings.

**Figure 2**  
**Summary of Base Case Energy Efficiency Program Savings and Costs**

		2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Energy Savings	(GWh)	355	354	336	319	302	288	274	260	248	235	224
Cumulative Energy Savings	(GWh)	355	709	1,045	1,363	1,666	1,954	2,227	2,488	2,735	2,971	3,194
Capacity Savings	(MW)	46	46	43	41	39	37	35	34	32	30	29
Cumulative Capacity Savings	(MW)	46	92	135	177	216	253	288	322	354	384	413
Annual Budget	(\$Mil)	\$180	\$181	\$181	\$180	\$180	\$181	\$181	\$181	\$182	\$182	\$182
Cumulative Budget	(\$Mil)	\$180	\$361	\$542	\$722	\$903	\$1,084	\$1,265	\$1,446	\$1,628	\$1,809	\$1,991

**Note:** Budget estimates are presented in nominal dollars.

Forecasting the energy efficiency values for 2014 and 2015 is straightforward since it is possible to use the EDCs’ forecasts, understanding that these forecasts are largely consistent with the

C&LM Plan budget that was approved by DEEP.<sup>3</sup> However, forecasting energy efficiency values for 2016 through 2024 is challenging. Savings are difficult to predict partly because savings opportunities are likely to experience diminishing returns after the most cost-effective measures are implemented. Nonetheless, a large volume of opportunities exists for additional installations, including the widespread adoption of the most basic elements of energy efficiency. Much work remains to reduce energy waste, weatherize 80% of residential properties, and to achieve all cost-effective energy efficiency. Even with increased activity in residential assessments and measure installations, additional implementation is required during 2016-2024 to achieve high levels of cost-effective efficiency. However, the cost per kWh of new annual energy efficiency (“cost of new energy efficiency”) is likely to increase.

In order to inform the cost of new energy efficiency beyond 2015, we reviewed the energy efficiency projections produced by ISO New England (ISO-NE) stakeholders. In 2012, ISO-NE established a regional forum, ISO-NE Energy Efficiency Forecast Working Group, for interested parties to provide input to ISO-NE concerning the energy efficiency forecast. ISO-NE and stakeholders then developed the energy efficiency forecasts to be used in the ISO studies looking beyond the Forward Capacity Market (FCM) timeframe as well as in the CELT report and Regional System Plan. The energy efficiency forecasts for each New England state is generated based on average production costs (cost of new energy efficiency), peak-to-energy ratios, and projected budgets of state regulated utility energy efficiency programs.

The ISO-NE Energy Efficiency Forecast Working Group investigated escalation rates for the cost of new energy efficiency and determined that a 5% year-over-year real growth rate would be appropriate. This is in addition to a 2.5% inflation rate assumed by the ISO.<sup>4</sup> The electric distribution companies already incorporate some of the increases in the cost of new energy efficiency through 2015 by accounting for the some of the changes in the lighting program portfolio, and by including programs that consist of deeper and more advanced measures that increase the cost of new energy efficiency in its current program cost calculations. Therefore, the electric distribution companies start their projections with a higher cost of new energy efficiency in 2015 based on actual budgets and escalate it at a lower nominal rate (5.3% nominal = 3% real + 2.3% inflation) starting in 2016 through 2024. When the annual average escalation rate is calculated over the 2011-2024 timeframe for the electric distribution companies’ projections, the nominal escalation rate is roughly 7.3% which is generally consistent with the ISO’s escalation rate. This approach ensures that the ISO and Connecticut electric distribution companies rely on consistent assumptions.

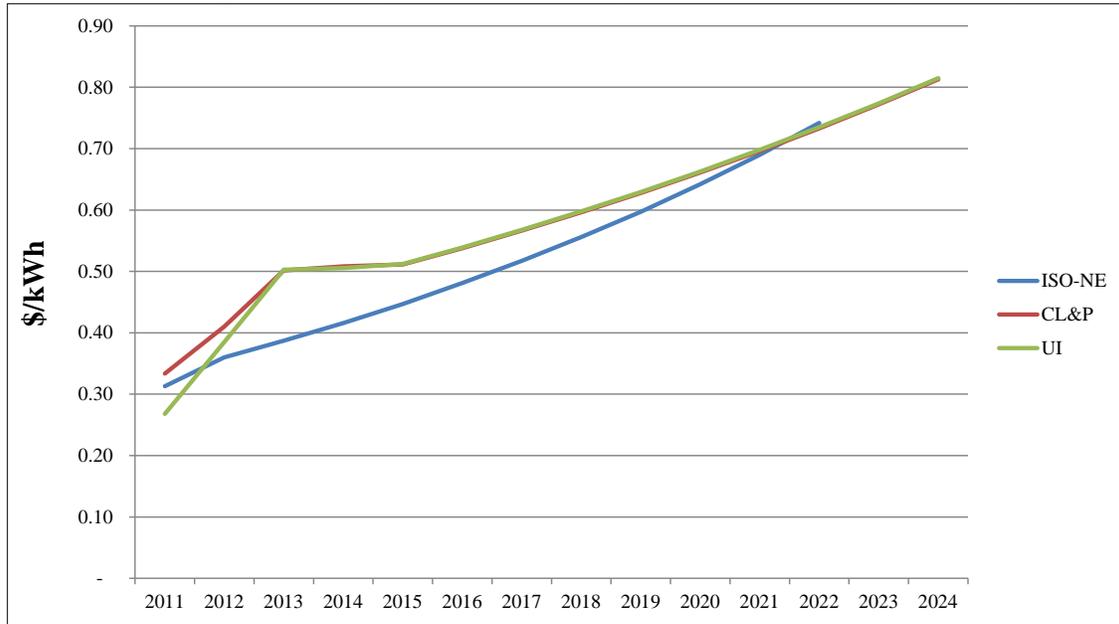
Figure 3 compares the cost of new energy efficiency in Connecticut as reported by the Connecticut electric distribution companies and ISO-NE over the 2011-2024 timeframe. While the CT EDC projections and ISO-NE projections may diverge in the interim period, they converge in the longer term and they imply similar annual average escalation rates over the 2011-2024 time frame.

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<sup>3</sup> The budget and savings reflect an approximation of the C&LM budget approved by DEEP for 2014 and 2015, as at the time of the construction of the Base Case EE model, the CL&M Plan was not final and approved by DEEP. For that reason, the cost rates assumed to derive the Base Case EE program savings also slightly differ from those assumed in the final C&LM Plan for 2014 and 2015.

<sup>4</sup> Final 2013 Energy-Efficiency Forecast: 2016-2022, available at [http://www.iso-ne.com/committees/comm\\_wkgrps/othr/engry\\_effncy\\_frctst/2013frctst/iso\\_ne\\_final\\_ee\\_forecast\\_2016\\_2022.pdf](http://www.iso-ne.com/committees/comm_wkgrps/othr/engry_effncy_frctst/2013frctst/iso_ne_final_ee_forecast_2016_2022.pdf).

**Figure 3**  
**Cost of New Energy Efficiency Based on CL&P, UI and ISO-NE Projections, 2011-2024**



**Source:** UI and CL&P projections, ISO-NE 2013 Final Energy Efficiency Forecasts for Connecticut

Uncertainties that could change the above projections include results from rebounding/snapback, free ridership, and spillover, and are considered as part of the ongoing review and evaluation of utility ratepayer-funded programs. Additionally, many programs are in a state of transition. There are other uncertainties involving economic factors, geopolitical events, weather, fuel costs, codes and standards, and it is difficult to generate estimates that capture such factors. Another example of uncertainty is the current lack of clarity in how statutory changes in fuel oil program spending will affect electric savings. Additionally, savings from non-utility ratepayer-funded energy efficiency programs are not easily or consistently captured. To address much of this uncertainty, ongoing evaluations of the utility ratepayer-funded programs are considered essential to narrow the range of potential inaccuracies in estimating the effect of and need for programs to achieve energy savings, as noted later in this Appendix. Finally, while the cumulative energy savings should increase over time, assuming spending remains at least constant, it is not certain what percentage will result from the utility-based programs captured in these budgets and savings estimates and what percentage will result from naturally occurring energy efficiency, for example that is achieved through the mainstreaming of efficient buildings, equipment, and behavior.

### **RELATIONSHIP TO ISO-NEW ENGLAND'S LOAD FORECAST**

While there have not been significant changes to the gross load forecasting methodology in the 2013 CELT forecast, there have been substantial changes to the forecast of Passive DR (“energy efficiency resources”). In the 2011 CELT forecast used for the 2012 IRP, the ISO held future Passive DR levels constant at the level cleared in Forward Capacity Auctions, and did not forecast additional quantities of Passive DR beyond those levels. In the 2013 CELT forecast, however, the ISO explicitly forecasts growth in Passive DR beyond the FCA levels. In our analysis, we rely on ISO-NE’s forecast of Passive DR for all New England states aside from

Connecticut. For Connecticut, we replace ISO-NE’s projections with the Base Case Energy Efficiency saving projections. Figure 4 presents ISO-NE’s energy efficiency projections for Connecticut; Base Case Energy Efficiency projections, and the delta between the two series, both expressed at the customer meter level. Note that ISO-NE published an updated forecast on June 3, 2014<sup>5</sup> that accounts for CT’s increased energy efficiency investments, however the forecast used in models developed for this IRP was the one available during the model production phase of this IRP.

**Figure 4**  
**ISO-NE and Base Case Energy Efficiency Projections for Connecticut, 2014-2024**

		2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
<b>ANNUAL</b>												
CELT EE	(MW)	-5	-6	-59	27	26	24	22	21	20	na	na
Delta	(MW)	51	51	103	14	13	13	13	12	12	na	na
Base Case EE	(MW)	46	46	43	41	39	37	35	34	32	30	29
CELT EE	(GWh)	163	-30	-212	217	204	192	179	169	158	na	na
Delta	(GWh)	192	384	548	102	99	96	95	92	89	na	na
Base Case EE	(GWh)	355	354	336	319	302	288	274	260	248	235	224

**Note:** ISO-NE CELT EE projections are at the generation busbar level. For the purposes of this figure, CELT EE savings are expressed at the customer meter level to be consistent with the Base Case EE savings.

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## POLICY APPROACHES TO REALIZING GREATER ENERGY SAVINGS

Since 2007, Connecticut law has directed the State to implement “all cost-effective energy efficiency.” Connecticut General Statutes 16a-3a(c) requires that “resource needs shall first be met through all available energy efficiency and demand reduction resources that are cost-effective, reliable and feasible.” Connecticut General Statutes Section 16-245m, as revised by Connecticut Public Act 13-298, requires that the state’s Conservation and Load Management Plan include a “budget sufficient to fund all energy efficiency that is cost-effective or lower cost than acquisition of equivalent supply.”<sup>6</sup>

DEEP is focused on ensuring that all utility-based energy efficiency achievements are cost-effective while at the same time continuing diverse efforts to reduce energy waste (such as raising building performance standards and product efficiency standards and weatherizing 80% of residential buildings by 2030). Additionally, to ensure consistency with state law, plans, and the federal Resource Conservation and Recovery Act<sup>7</sup>, Connecticut must continue to ensure that energy waste is reduced through reducing materials and goods waste, by recovering the maximum value of materials through reuse and recycling, and recovering the energy value in non-recyclable materials. DEEP will continue to monitor the performance and cost-effectiveness of new utility ratepayer-funded efficiency measures through multi-year C&LM Plan review and

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<sup>5</sup> ISO New England, Inc System Planning, *ISO-New England Energy Efficiency Forecast Report for 2018-2023*, June 3, 2014

<sup>6</sup> See Public Act 13-298, section 16, available at [www.cga.ct.gov/](http://www.cga.ct.gov/)

<sup>7</sup> The federal Resource Conservation and Recovery Act (RCRA) requires pollution prevention and the conservation of natural resources and energy through waste minimization, efficient materials management, and the recovery of materials and energy value from discarded materials.

approval processes and through reviews of annual C&LM Plan updates. DEEP also plans to pursue an updated assessment of energy efficiency potential opportunities in order to identify future savings opportunities from energy waste reduction.

Energy efficiency could be expanded through both increased C&LM program funding and by complementary measures. Such complementary measures could include updating building codes and standards, requiring more efficient consumer products, offering additional financing mechanisms, achieving broader participation in energy efficiency opportunities, or other innovative means. This set of strategies is assessed by assuming further energy efficiency measures. Increased energy efficiency can achieve 1,620 GWh of load reductions in Connecticut corresponding to a 5% load reduction for the state load in 2024. Current and potential future actions and programs to achieve integrated environmental and energy efficiency policies include expanded innovative financing, market transformation, customer behavioral changes, and improved building codes and standards.

### **Continue Expanding Financing**

Customer financing can help to achieve further energy efficiency savings with less reliance on incentives. In 2011 Connecticut established a quasi-public organization called the Clean Energy Finance and Investment Authority (CEFIA) as a successor agency to the Connecticut Clean Energy Fund, formed in 2000. CEFIA was created to attract and deploy capital to provide low-cost financing for clean energy and energy efficiency projects. In this role as a “Green Bank,” CEFIA leverages public and private funds to drive investment and accelerate clean energy deployment across Connecticut in all sectors: residential, low-income residential, commercial, industrial, government, and institutional.<sup>8</sup> In 2013 CEFIA was re-named the Connecticut Green Bank.

Since the 2012 IRP, the Connecticut Green Bank has developed several programs that have expanded capital resources for the residential and commercial and industrial sectors. In 2013 the Connecticut Green Bank leveraged approximately \$40 million of its funds to attract more than \$180 million in private capital investment. Of the \$40 million of resources that it used, an estimated \$20 million will be returned over time as the financing was in the form of loans and leases versus grants – yielding a 10:1 leverage ratio of private to public funds. Its approaches include partnering with capital providers such as local credit unions and community, state, regional and national banks to attract their investment in clean energy in order to provide customers and contractors with easy access to affordable capital. With the resources the Connecticut Green Bank has attracted, 50 megawatts (MW) of clean energy is being deployed in Connecticut’s homes, businesses and institutions, including:

- The largest fuel cell power plant in the country: a \$65 million, 15-MW fuel cell project located on a remediated brownfield in Bridgeport that uses technology that is manufactured in Connecticut.
- The first public-private partnership to finance residential and commercial and municipal solar PV leases and residential solar thermal hot water system leases to offer consumers a cleaner and cheaper energy alternative. This project brought in a tax equity investor and

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<sup>8</sup> More information at [http://www.ctcleanenergy.com/CEFIA\\_2\\_Page\\_Brochure.pdf](http://www.ctcleanenergy.com/CEFIA_2_Page_Brochure.pdf)

a syndicate of local debt providers (who together have committed \$50 million through 2015).

- The launching of the state’s Commercial Property Assessed Clean Energy (C-PACE) program to help commercial, industrial, multifamily and non-profit energy end-users install deeper energy efficiency measures, convert to natural gas, and deploy on-site renewable energy and combined heat and power. The funding is continuously replenished using an auction process to sell the committed transactions to private capital providers.
- Created in 2013 with a group of community banks and credit unions the Smart-E residential energy efficiency and clean energy loan program. The Smart-E Loan provides consumers with easy access to affordable capital from which to finance measures that are consistent with the implementation of the Comprehensive Energy Strategy as well as healthy home measures such as asbestos removal, lead abatement, mold remediation, etc. A loan loss reserve, made possible with American Reinvestment and Recovery Act (ARRA) funding, supports an initial \$30 million pool of capital available for an array of energy conservation measures at affordable rates and flexible terms up to 12 years. At an average loan size of \$10,000 an estimated 3,000 projects will be supported. By spreading the initial costs over a longer time period, these investments can be immediately cash flow positive for homeowners. Eligible “Bundles” also qualify for a lower interest rate, which is a significant financial motivator to encourage deeper energy conservation measures. Banks and credit unions are excellent local partners with a commitment to the communities they serve and a desire to build good loan volume with creditworthy homeowners. As such, the supply of capital can easily grow beyond the initial pool as market demand increases.
- Establishing the Cozy Home loan program with a Community Development Financial Institution called the Housing Development Fund, which supports homeowner energy conservation investments at or below 80% of area median income, providing access to capital for a demographic group that is often challenged to obtain affordable long term financing. A loan loss reserve made possible with ARRA funding supports a \$2.5 million pool of capital to support approximately 250 loans. This loan program also supports healthy home measures to correct health and safety issues ancillary to efficiency upgrades.
- Creating the first dedicated solar loan product with a solar financing partner. This product offered an affordable interest rate for 15 years using \$4 million of investment from new capital sources – an online crowd-funding platform together with a family office foundation.

The Connecticut Green Bank will continue to develop funding sources and structures to ensure the state has adequate capital resources for clean energy and energy efficiency investments across all sectors and technologies. Some of the programs under active development include:

- Development of residential financing options that offer a security interest and transferability for private capital providers, thus enabling low-cost, long-term capital to customers. The Connecticut Green Bank is developing an open market on-bill

financing program in conjunction with the Energy Efficiency Board and the utilities, with Smart-E targeted as the initial loan program to be supported. This is expected to be helpful to residents, as the repayment method is consistent with the on-bill repayment approach for certain existing utility-sponsored financing that has proven helpful in encouraging uptake of deeper measures such as insulation and efficient heating equipment. Residential PACE is also being explored as another option to provide low-cost, long-term financing for residents.

- A multifamily residential market to undertake cost effective measures. The Connecticut Green Bank is working with various partners including the Department of Housing, the Connecticut Housing Finance Authority, the Connecticut Housing Investment Fund, DEEP, the utilities, local Community Development Financial Institutions, a C-PACE capital provider, and the MacArthur Foundation, who is making a program related investment in the Green Bank to support this work. Previously progress in this market has been difficult due to a variety of factors: split incentives related to utility cost savings between tenants and owners, lack of capital for upgrades, programmatic and regulatory restrictions on publicly funded properties, lack of performance data and case studies to build the business case, and a lack of general market knowledge around implementation and benefits to serve underserved populations (credit-challenged, low income residents). With the success of the Connecticut Green Bank's financing options and the maturation of the private market, there is an opportunity to leverage private offerings for "prime" (non-credit challenged) residential customers and focus the Green Bank's support on remaining gaps in the market.
- Crowd-funding is as renewable a source of funding as the projects they fund, so that the initial pool of capital can be expanded as homeowner solar financing needs grow. The prospect of everyday investors investing in clean energy deployment by their neighbors is something that the Connecticut Green Bank is working on to open up clean energy investments in Connecticut for its citizens.
- With DEEP, the Connecticut Green Bank is coordinating efforts to support Connecticut's infrastructure. This includes financing the hundreds of millions of dollars needed to finance energy savings performance contracts (where the energy conservation measures are financed through energy savings that are guaranteed by the installer) that will result in significant energy savings at state buildings. The opportunity for savings from state buildings and facilities is significant, likely likely exceeding 1,023,297 MMBtu annually. Municipalities face similar budget challenges as state agencies; therefore this financing assistance will be made available to municipalities throughout the state to promote energy conservation at town buildings.
- The Connecticut Green Bank is also collaborating with DEEP to develop a financing program to complement DEEP's pilot program for the development and funding of distributed generation microgrids for grid stability and reliability, and infrastructure for a network of electric vehicle charging stations to alleviate "range anxiety" and promote broader use of electric vehicles.

- For educational institutions, colleges, and universities, the Connecticut Green Bank expanded a pilot program with the Connecticut Conference of Independent Colleges that uses no-upfront-cost energy savings agreements to reach a greater number of schools while continuing to promote deeper energy savings measures.
- Consistent with Connecticut's Climate Change Action Plan and Solid Waste Management Plan, the Connecticut Green Bank is working with DEEP's efforts to build Connecticut's recycling infrastructure to better manage source separated organic material, especially food wastes. The Connecticut Green Bank is supporting the development of non-fossil power generation fueled through anaerobic digestion facilities in which food waste is decomposed in an accelerated manner to produce methane gas. This process can take tens-of-thousands of tons of food waste and use the resulting methane gas to generate several megawatts of electricity more efficiently than through typical waste-to-energy facilities while also generating a marketable compost product.
- Building on the Bridgeport fuel cell project (and several projects developed by its predecessor - the Clean Energy Fund) the Connecticut Green Bank is now working with capital providers, DECD, DEEP, the Treasurer's Office, and Connecticut Innovations through the Renewable Energy and Efficient Energy Finance Program and other programs to spearhead a fuel cell development program targeting commercial and industrial projects that could benefit from the high efficiency and reliability offered by this distributed energy technology.

The Connecticut Green Bank complements other features of the 2013 Comprehensive Energy Strategy for Connecticut's energy efficiency goals, renewable energy targets and economic development. According to the Connecticut Green Bank's estimates, the 50 MW of clean energy being deployed is creating nearly 2,000 jobs – 650 direct and 1,350 indirect and induced – and the projects will eliminate approximately 400,000 tons of greenhouse gas emissions over their lifetimes. Projects undertaken and supported over the 2014-15 period will support an even greater number of locally sourced jobs and, such as with fuel cells, locally sourced technology and equipment. Furthermore, by promoting financing with local sources of capital, Connecticut's Green Bank helps local dollars to promote economic activity within the state, providing an even greater economic multiplier effect.

CEFIA/Connecticut Green Bank also builds on existing programs. For example, the utility companies manage loan programs that offer subsidized, low interest rate loans to customers who make qualified energy efficiency improvements, and offer on-bill repayment provisions. Utility and state loan programs are particularly important because commercial banks currently show little interest in offering energy efficiency financing to small customers. Typically, commercial banks grant loans only to energy service companies (ESCOs), who manage the projects for large commercial and industrial customers.

Examples of Connecticut's financing programs for the residential, commercial, industrial sectors include the following loans offered through the utility companies and other entities:

1. The Energy Conservation Loan (ECL) Program and Multifamily Energy Conservation Loan (MEL) Program after financing at below-market rates to single family and multifamily residential property owners for energy efficiency investments;

2. The HES On-Bill Financing Loan offers subsidized, low-interest rate, unsecured loans with on-bill repayment which are provided either through utility or Energy Efficiency Fund resources;
3. The Small Business Energy Advantage (SBEA) and Municipal Program offers zero percent, on-bill loan repayment to small businesses and government customers for small-scale projects;
4. The Small Commercial and Industrial Loan offers reduced interest loans through a third party financing entity;
5. The Commercial and Industrial Loan offers low-interest subsidized financing for energy efficiency projects costing more than \$1,000,000; and
6. The EnergizeCT Heating Loan offers low-interest financing for energy efficient residential furnace and boilers, with simple qualifying terms, and provides for repayment on electric bills.

### **Accelerate Market Transformation**

“Market transformation” refers to the strategic process of intervening in a market to create lasting change in market behavior by removing identified barriers or exploiting opportunities to accelerate the adoption of all cost-effective energy efficiency as a matter of standard practice.<sup>9</sup> Market transformation is aimed at changing the “business-as-usual” practices to a higher state of energy efficiency. The expectation is that market transformation will result in more market-based implementation of energy efficiency services and products.

Market transformation can be implemented through different channels: (i) interventions that directly address identified market barriers; (ii) competitive market forces, private capital, and information sharing that drive energy efficiency gains; and (iii) collaborations between government, private sector, consumers, and other stakeholders that influence market structure and functioning.<sup>10</sup>

The utility companies recognize that C&LM programs are crucial in transforming the current institutionally supported paradigm to a market model that will become the “new normal”<sup>11</sup> and they focus on maintaining deeper savings by implementing more comprehensive energy efficiency measures while contributing to the market transformation process. The multi-year C&LM plan emphasizes programs and initiatives that promote sustainable energy management as a core consumer and business value: “Ultimately, as the green market grows, programs should

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<sup>9</sup> <http://www.aceee.org/topics/market-transformation>

<sup>10</sup> Sabrina Birner and Eric Martinot, “Market Transformation for Energy Efficiency Products: Lessons from Programs in Developing Countries,” *Energy Policy*. Available at [http://www.martinot.info/Birner\\_Martinot\\_EP.pdf](http://www.martinot.info/Birner_Martinot_EP.pdf).

<sup>11</sup> 2013-2015 Electric and Natural Gas Conservation and Load Management Plan, November 1, 2012, page 10, available under Docket No. 13-03-02 at <http://www.ct.gov/pura/docketsearch>. Also available under “Public Act 11-80-Section 33-2013-2015 Conservation and Load Management Plan” at <http://www.ct.gov/deep/energyfilings>.

move from a primary dependency on public benefit charges to a more self-sustaining industry that can be supplemented, or leveraged, through Energy Efficiency Fund resources.”<sup>12</sup>

### **Induce Behavioral Change through Awareness and Information**

Behavioral change induced by information is one of the ways market transformation operates. As more and more customers become informed about efficient energy practices and their financial and societal benefits, more customers are expected to invest in better measures and practices without relying on incentive mechanisms. However, most customers do not have easy access to detailed information about how to save energy costs effectively. The most direct way to address this market failure is to find innovative ways to provide information to customers. Home energy reports, scores, and labels provide a way to isolate efficiency measures installed in an individual asset. A market shift will occur when users signal a preference for these reports and owners see it in their interest to not only disclose but promote the energy usage and efficiency statistics of their buildings. These statistics can be standardized and may include utility bills, building envelope characteristics, and other measures that indicate the energy efficiency level of a building. It is expected that this kind of disclosure will incentivize building owners to make efficiency investments, as buyers develop an interest in higher efficiency residences and office spaces and reduced future operating and energy costs.

The energy efficiency of consumer products such as electronics and appliances are continuously being improved, with states such as Connecticut joining with other states and the US DOE to drive improved product efficiency standards. Additionally, the provision of energy efficiency information labels on manufactured products is another way of addressing the market failure in information provision. If these labels provide clear, helpful, and standardized information about the efficiency of products, customers are then able to make on-the-spot comparisons and as a result more informed purchase decisions. As increasing numbers of customers make purchase decisions not only based on price and quality, but also on the energy efficiency rating of the products, the expectation is that the inefficient products will be driven out of the market. The ultimate goal is to make manufacturers compete on the energy efficiency of their products, in addition to other attributes such as quality and price.

Other areas are ripe for energy efficiency outreach. The Energy Efficiency Board, Companies, Connecticut Green Bank, and DEEP are implementing a Statewide Marketing Plan with harmonized public outreach and advertising campaigns to address the information challenge and induce more efficient behavior. The outcome of the campaigns is expected to be increased awareness and access to information about making investments in energy efficiency measures in all sectors.

### **Update Building Codes and Standards**

Another effective way of accelerating transformation of the market is to revise existing building codes and standards so that energy efficient buildings are the norm. Some current codes and standards provide baseline measures that have sub-optimal levels of energy efficiency.

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<sup>12</sup> 2013-2015 Electric and Natural Gas Conservation and Load Management Plan, November 1, 2012, page 10, available under Docket No. 13-03-02 at <http://www.ct.gov/pura/docketsearch>. Also available under “Public Act 11-80-Section 33-2013-2015 Conservation and Load Management Plan” at <http://www.ct.gov/deep/energyfilings>.

Connecticut is revising its laws and regulations to ensure that state-funded new construction and renovation projects achieve higher levels of efficiency and the state building code reflects updated International Energy Efficiency Codes.

### **Program Evaluation**

Evaluation studies perform a critical function in determining whether programs are cost-effective and are implemented to achieve maximum savings. Evaluation studies perform an especially important strategic function to assure that ramped up residential and commercial and industrial sector programs are successfully implemented, programs achieve their savings goals, and new savings opportunities are revealed.<sup>13</sup> As part of its role in developing energy efficiency programs the Department, in collaboration with the Connecticut Energy Efficiency Board, ensures that an objective third-party evaluation administrator evaluates the programs funded by the Connecticut Energy Efficiency Fund.

### ***Future Assessment of Energy Efficiency Opportunities***

DEEP is committed to working on improved analytics, including an updated and dynamic assessment of the statewide opportunities for energy efficiency, to better inform future IRPs and other state plans. This improved data is expected to more precisely guide the implementation of the diverse array of state policy actions targeted at reducing wasted energy and ensuring the achievement of energy efficiency and controlled load growth.

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<sup>13</sup> See C&LM Final Decision, page 88, available under “Public Act 11-80 – Section 33-2013-2015 Conservation and Load Management Plan,” available at <http://www.ct.gov/deep/energyfilings>.