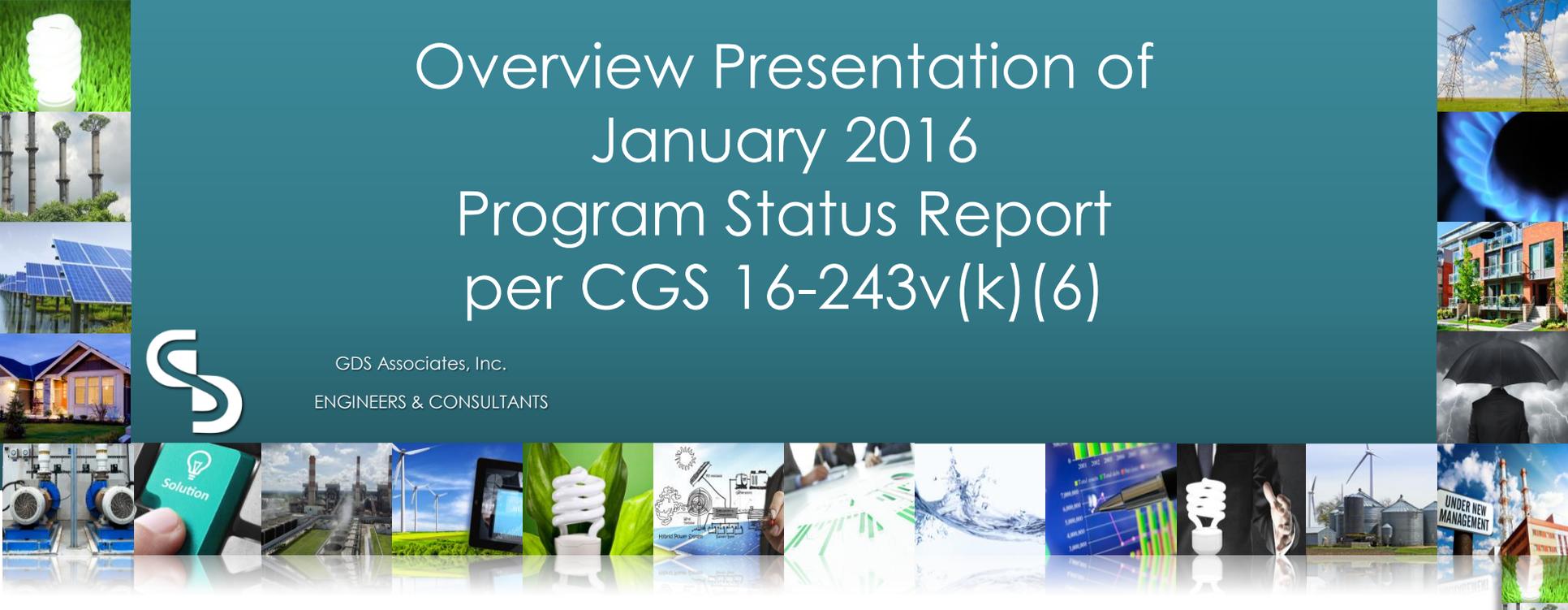


Overview Presentation of January 2016 Program Status Report per CGS 16-243v(k)(6)



GDS Associates, Inc.
ENGINEERS & CONSULTANTS



GDS PREPARED THIS REPORT ON BEHALF OF THE CONNECTICUT DEPARTMENT OF ENERGY AND ENVIRONMENTAL PROTECTION AND THE CONNECTICUT ENERGY CONSERVATION MANAGEMENT BOARD [ENERGY EFFICIENCY BOARD] IN FULFILLMENT OF THEIR RESPONSIBILITIES PURSUANT TO CGS 16-243v(k)(6). THE STATUTE REQUIRED DEEP AND THE ENERGY EFFICIENCY BOARD (EEB) TO ENGAGE AN INDEPENDENT THIRD PARTY TO EVALUATE AND PREPARE A REPORT ON THE STATUS OF IMPLEMENTATION OF THE RESIDENTIAL FURNACE AND BOILER REPLACEMENT PROGRAM AND THE CLEAN ENERGY ON-BILL REPAYMENT PROGRAM. PLEASE NOTE THAT NEITHER OF THESE PROGRAMS ARE ADMINISTERED AS PART OF THE CONNECTICUT ENERGY EFFICIENCY FUND'S CONSERVATION AND LOAD MANAGEMENT PLAN [CGS 16-245M]. THEREFORE THE EEB HAS HAD LIMITED INVOLVEMENT IN THE PRODUCTION OR APPROVAL OF THE REPORT.

January, 2016

MANDATE

This report was submitted in accordance with Connecticut General Statutes (CGS) Title 16, Section 16-243v(k)(6), as amended, which requires:

“On or before January 1, 2016 and on or before January 1, 2018, the Department of Energy and Environmental Protection and the Energy Conservation Management Board shall engage an independent third party to evaluate and submit a report, in accordance with section 11-4a, to the joint standing committees of the General Assembly having cognizance of matters relating to energy and finance, revenue and bonding on the status of the program. Such report shall also include an evaluation of the [Residential Furnace and Boiler Replacement] program developed pursuant to section 16a-40m [the Residential Clean Energy On-Bill Repayment Program]. The report shall include, but not be limited to, for each program, a review of (A) cost effectiveness of the program, (B) number of customers served and potential for growth, (C) the customer classes served, and (D) the fuel type of the financed equipment.”

NOTE:

GDS prepared this report on behalf of the Connecticut Department of Energy and Environmental Protection and the Connecticut Energy Conservation Management Board [Energy Efficiency Board] in fulfillment of their responsibilities pursuant to CGS 16-243v(k)(6). The statute required DEEP and the Energy Efficiency Board (EEB) to engage an independent third party to evaluate and prepare a report on the status of implementation of the Residential Furnace and Boiler Replacement Program and the Clean Energy On-Bill Repayment program. Please note that neither of these programs are administered as part of the Connecticut Energy Efficiency Fund's Conservation and Load Management Plan [CGS 16-245m]. Therefore the EEB has had limited involvement in the production or approval of the report.



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RESIDENTIAL FURNACE & BOILER REPLACEMENT PROGRAM

- The Residential Furnace & Boiler Replacement Program began at the start of the 2014 calendar year.
- This program is available to all residential electric, gas or heating fuel customers of Connecticut’s Eversource or United Illuminating utility companies, regardless of heating source, who would like to replace heating furnace or boiler equipment. The equipment being replaced must be the primary heating equipment for space and hot water needs and meet or exceed federal ENERGY STAR® standards.
- To be eligible, customers must be the homeowner and have six consecutive months of timely utility payments and no more than two late payments in the past twelve months. Additionally, customers will not be eligible if they have any overdue balances to any electric distribution company (EDC) or gas company.
- Financed projects may receive up to \$15,000 and must have a loan term of the lesser of simple payback of the replacement funds plus two years OR ten years. The customer is required to contribute a minimum down payment of 10 percent.
- During the course of this evaluation, customer loans were at both 2.99% and 0% (with a majority of the volume at 0%). The average cost per loan over this term was approximately \$1,100/loan. Of this \$1,100 per loan the cost allocation is as follows: loan origination and servicing was approximately \$1,000/loan (92%); program administration and marketing was approximately \$63/loan (6%) and loan defaults was approximately \$20/ loan (2%). Note: Since November 1, 2015 the interest rate being charged to customers is 2.99% which will offset the loan origination and servicing costs of \$1,000/loan. The program administration and loan default costs are recovered from Connecticut’s electric ratepayers through the System Benefits Charge.
- The table below shows actual and budgeted loan amounts from program start through 2016. It is important to note that interest rates for loans started at 2.99% and were reduced to 0% beginning October, 2014. This rate returned to 2.99% effective November 1, 2015. Also, please note, future participation may not meet the 2016 estimates given recent fuel price reductions being experienced nationwide and the program’s increased interest rates (back to 2.99%) for furnace and boiler replacement loans. However the use of the 2.99% interest rate will better allow the alignment of current financing offerings in Connecticut, addressing some of the concerns aired by the Connecticut Green Bank – that a 0% rate subsidized by electric ratepayers may negatively affect uptake of private market participation in lending for energy upgrades, and concerns raised by the Energy Efficiency Board consultants – that the use of a 0% interest rate could negatively affect the alignment of financing offerings in Connecticut.

	Eversource		United Illuminating		Total	
	# of Loans	Loan Amount	# of Loans	Loan Amount	# of Loans	Loan Amount
2014 Actual	403	\$3,131,928	187	\$1,460,480	590	\$4,592,408
2015 10 mo Actual	1,693	\$13,896,917	638	\$5,043,500	2,331	\$18,940,417
2016 Budget Estimates	1,500	\$12,346,500	425	\$3,500,000	1,925	\$15,846,500

Source: Raw data from dashboard for period 1/1/2014 through 11/17/2015 and EDC budget estimates for 2016
 The above costs do not reflect the \$1,100 per loan as per Bullet 5 above.



RESULTS SUMMARY - RESIDENTIAL FURNACE & BOILER REPLACEMENT PROGRAM

Cost Effectiveness of Program* (values equal to or greater than 1.0 ensure that savings equal or exceed costs)

- Total program cost effectiveness from program start through November 17, 2015 from participants' perspective only (excluding customer co-pays, rebates, etc.) is 1.44.
 - When broken down by improvement type, furnaces and boilers are the most cost effective (1.46 and 1.45), followed by air-to-air heat pumps (1.41), ductless heat pumps (1.40), and ground source heat pumps (1.34).
 - When broken down by fuel type, gas is the most cost effective fuel (1.47), followed by propane (1.46), oil (1.41), and electric (1.40).
- Total program cost effectiveness from program start through November 17, 2015 from a modified utility test benefit/cost perspective is 9.1.
 - When broken down by improvement type, ground source heat pumps (13.6) and ductless heat pumps (11.3) have the highest ratios, followed by furnaces (9.0), boilers (8.8), and air-to-air heat pumps (7.4).
 - When broken down by fuel type, gas (11.8) and electric (10.2) have the highest ratios, followed by propane (4.2) and oil (1.0).
- Total program cost effectiveness from program start through November 17, 2015 from a total program benefit/cost perspective is 2.64.
 - When broken down by improvement type, furnaces (2.83) and boilers (2.79) have the highest ratios, followed by air-to-air heat pumps (2.23), and ductless heat pumps (2.08).
 - When broken down by fuel type, gas (2.89) and propane (2.62) have the highest ratios, followed by oil (2.59) and electric (1.95).

Number of Customers (1/1/14 to 11/17/15)

- Of the 8,003 customer application records within the program, 3,145 (39%) have already been funded over this nearly 2 full year study period, with 21% others approved or preapproved, 24% declined, 12% withdrawn, and 4% under review.
- Of the 2,921 funded projects where data is available for analysis, the majority (57%) are boiler improvements, followed by 26% furnace upgrades. The remaining 17% of funded projects are for a mix of ductless heat pumps, air-to-air heat pumps and ground source heat pumps.
- A majority of these funded projects are using gas as their fuel (59%), oil and electric come next at 19% and 17% respectively, and propane has the lowest distribution as fuel of funded projects at 5%.

Potential for Program Growth

- Equipment-based potential: Of the total 1,394,888 combined Eversource and United Illuminating residential electric customers, an estimated remaining potential for additional participation in the Residential Furnace & Boiler Loan Program could range between 13,500 to 28,000 over the next five years (1.0% to 2.5% of the State's total eligible residential households population), this equates to 2,700 and 5,600 systems per year. These estimates are based solely on replacing aging (over 10 years old) systems, not on retrofitting newer units.
- Connecticut's ability to finance furnace and boiler replacements through this program is limited by ratepayer dollars available to capitalize loans, and also by customer interest in pursuing furnace and boiler replacement projects - which could be impacted by the price of existing home heating fuels and the interest rate associated with the program's equipment loans.
- Based off this estimated program potential for growth, annual contributions from electric ratepayers will be fully offset between the years 2022 and 2023 for all three projected low, mid and high loans-issued scenarios.

Customer Classes Served

- 21% of the customers served through this program have annual household incomes at or below 60% of the State's median income (35% are at or below 80% of State median income)
- A majority of the residential customers served through this program fall within two annual household income ranges: \$25,000 to \$74,999 (37% of customers served) and \$75,000 to \$150,000 (38%).
- Within all of the income ranges served, Boilers are consistently the most common improvement type followed by Furnaces.
- Within all of the income ranges served, gas is consistently the most common fuel for the replaced equipment.
- For customers participating in the program with household incomes ranging from \$0 to \$249,999, oil is the second most common fuel for replaced equipment. Among customers with annual household incomes at or above \$250,000 the second most common equipment fuel type is electric (heat pumps).

Fuel Type of Financed Equipment

- The boilers and furnaces funded through this program are most commonly fueled by gas. The air-to-air, ductless and ground source heat pumps all are commonly fueled by electricity.
- When funded furnace and boiler replacements require switching from one fuel to another, most of such fuel switches are with new boilers changing from oil to gas. The next most common is a switch from oil to electric heat pump for new air-to-air, ductless or ground source heat pump systems.

CO₂ Emissions

- A projected total of 4,177 metric tons of CO₂ savings will be realized annually through projects already funded.
- The large number of funded improvements that are fueled by gas have resulted in the greatest total amount of annual CO₂ reductions (over 2,500 metric tons reduced per year), followed by electricity-fueled improvements (approximately 1,200 metric tons) and mainly driven by oil-to-gas and oil-to-electric heat pump conversions.
- The lesser number of improvements where the base and new equipment remain fueled by oil, have resulted in the least amount of CO₂ savings when viewed across the total number of program-funded improvements.

* These benefit-cost results are presented for informational purposes only and should not be used to assess overall program success or failure. Additional research is needed to determine appropriate baseline conditions and/or quantify the impact of customer incentives that were received outside of this program.



METHODOLOGY - RESIDENTIAL FURNACE & BOILER REPLACEMENT PROGRAM RESULTS STUDY

- Loan data from program start (January 1, 2014) to a cut-off date of November 17, 2015 were used to evaluate all projects in this study.
- All data were reviewed to identify only those projects with complete data sets for use in the study's remaining analyses – see Appendix A for the data review and cleaning process.
- Evaluation of cleaned data set proceeded to assess results in the following six study areas:
 - **Cost Effectiveness of Program***
 - Total projected direct cost savings of eligible customers was divided by the total cost of replacement funds over term of loan to determine total program cost effectiveness from the loan portion of each participants' perspective (excluding customer co-pays, rebates, etc.).
 - Cost effectiveness was then calculated by improvement type (furnaces, boilers, heat pumps, etc.) and fuel type (gas, oil electricity, propane).
 - Finally, cost effectiveness was calculated using data sorted by type of fuel before and after equipment upgrade to determine the most cost effective group of program-funded fuel switch projects.
 - A modified utility cost test was used to assess cost effectiveness from a utility perspective (where avoided cost savings benefits were divided by the utilities' \$1,100 admin cost per loan).
 - An additional total program cost perspective test was used which added the \$1,100 admin cost per loan and upfront customer contribution to the total amount financed for the cost portion of the ratio. Customer savings over the measure life was also included (vs. the loan term)
 - **Number of Customers**
 - In addition to categorizing all 8,003 customer applications during the study period, all customers were separately sorted by loan rate, improvement type, fuel type, application status, loan term, and fuel switch to summarize program results by these other important reporting categories.
 - A map was then generated to show distribution across the state of all funded projects in the cleaned data set.
 - **Potential for Program Growth**
 - Potential for program growth was determined by starting with the State's total residential household counts and narrowing this population down to the number of residential customers eligible as program participants.
 - Two equipment-based remaining potential scenarios were then run, both of which started with eligible population. The 1st made adjustments, based on a recent study that included phone surveys with residential customers to estimate actual age of current systems and recognize customer behavior for replacing old equipment. The 2nd scenario used results from a CT-based residential weatherization study to estimate the percentage of furnace and boiler replacements each year occurring both within and outside of the Loan Program.
 - From this program potential for growth analysis, the number of annual loans was projected for low, mid, and high participation.
 - Loan amounts issued and the resulting loan repayments over time were compared for the three scenarios of low, mid, and high projected participation over the next ten years to find the points at which annual loan repayment amounts fully offset the annual outflow of new loans issued.
 - **Customer Classes Served**
 - All customers in the cleaned data set were sorted into six annual household income ranges and further broken down by the type of improvement financed, fuel type of financed equipment, and type of fuel switch. All income ranges were based solely on self-reported values.
 - Analysis was also conducted to show participation by customers with household incomes at or below 60% and 80% of State Median Income.
 - **Improvement Type by Fuel Type**
 - Data were sorted by financed improvement type and fuel type to identify the types of fuels predominantly used for new systems installed.
 - Data were also sorted by type of fuel switch from the base system to the new system to determine which improvement types were most commonly associated with the various fuel switch combinations.
 - **CO₂ Emissions**
 - CO₂ estimates were calculated from million British thermal units (MMBtu) savings per customer converted to metric tons using a factor specific to the fuel type. Results were presented in total, by fuel type, improvement type and by fuel switch combination.

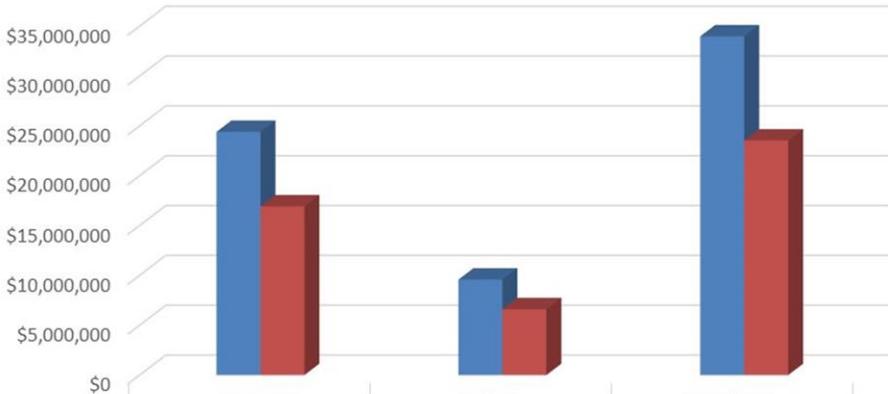
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COST EFFECTIVENESS OF PROGRAM – PARTICIPANT PERSPECTIVE*

- As seen in the chart to the right, for the 2,921 total funded projects assessed, the overall program cost effectiveness is 1.44 (1.44 for Eversource, 1.45 for UD).
- Over \$23.5 million will have been paid by funded participants over their loan periods resulting in nearly \$34 million in projected direct cost savings benefits (based on the cost of existing and replacement fuels at the time each loan was approved).
- See Appendix B for detailed tables on this study’s cost effectiveness analysis effort.

Cost Effectiveness by Utility - Participant Perspective



Total Number of Funded Applications (n)	2,096	825	2,921
Total Projected Direct Cost Savings	\$24,402,153	\$9,581,078	\$33,983,231
Total Cost	\$16,929,762	\$6,603,063	\$23,532,825
Average Program Cost Effectiveness	1.44	1.45	1.44

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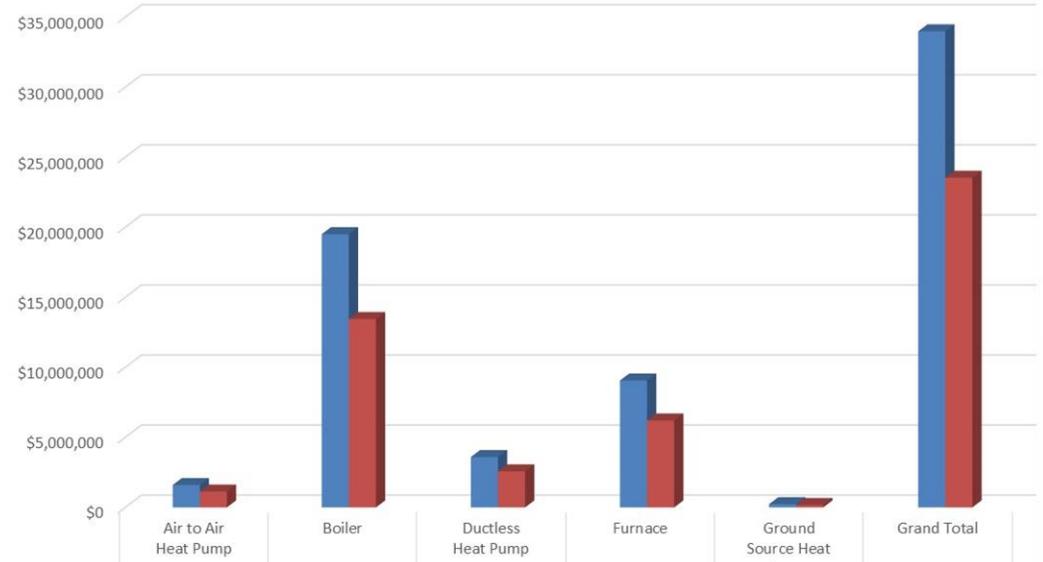


COST EFFECTIVENESS OF PROGRAM* - BY IMPROVEMENT TYPE (PARTICIPANT & UTILITY PERSPECTIVES)

- From a participant's perspective only, the cost effectiveness ratio calculates to 1.44 across all improvement types.
 - Furnaces and boilers are the most cost effective improvement types funded (1.46 and 1.45 respectively).
 - Boilers are the most frequent improvement type funded (1,666) followed by furnaces (772).
- From a modified utility test benefit/cost perspective, the ratio calculates to 9.1 across all improvement types (based on an estimated utility cost per loan of approximately \$1,100).**
 - Ground source heat pumps (13.6) and ductless heat pumps (11.3) have the highest ratios, followed by furnaces (9.0), boilers (8.8), and air-to-air heat pumps (7.4).

** Going forward the benefit/cost ratio will be higher because customers will be picking up most of the cost due to the interest rate change to 2.99%. However, the utilities maintain control over the level of the interest rate so it is possible that the interest rate could be adjusted downward again, negatively affecting the benefit/cost ratio.

Cost Effectiveness by Improvement Type - Participant Perspective



Total Number of Funded Applications (n)	139	1,666	322	772	22	2,921
Total Projected Direct Cost Savings	\$1,594,717	\$19,502,082	\$3,596,256	\$9,058,610	\$231,566	\$33,983,231
Total Cost	\$1,127,628	\$13,449,806	\$2,576,693	\$6,205,760	\$172,938	\$23,532,825
Average Program Cost Effectiveness	1.41	1.45	1.40	1.46	1.34	1.44

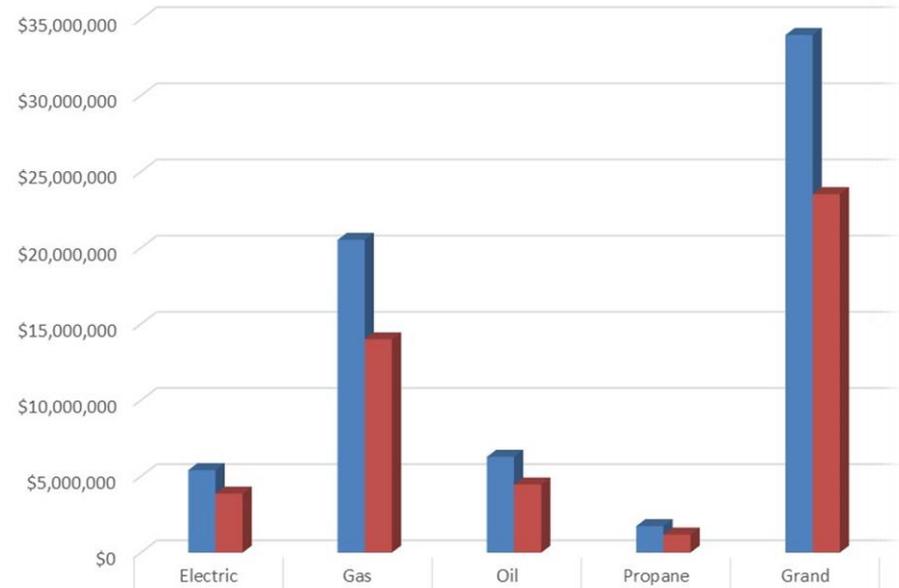
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COST EFFECTIVENESS OF PROGRAM* - BY FUEL TYPE (PARTICIPANT & UTILITY PERSPECTIVES)

- From a participant's perspective only, the cost effectiveness ratio calculates to 1.44 across all fuel types.
 - Of the 2,921 funded projects having complete data available for analysis, improvements fueled by gas are by far the most common (n=1,738), and also the most cost effective at 1.47.
 - Funded projects fueled by propane are the second most cost effective at 1.46, though only 5% of projects use this fuel.
 - Oil- and electric-fueled projects have cost effectiveness ratios slightly lower at 1.41 and 1.40 respectively.
- From a modified utility test benefit/cost perspective, the ratio calculates to 9.1 across all fuel types (based on an estimated utility cost per loan of approximately \$1,100).
 - Gas (11.8) and electric (10.2) have the highest ratios.

Cost Effectiveness by Fuel Type - Participant Perspective



	Electric	Gas	Oil	Propane	Grand Total
Total Number of Funded Applications (n)	482	1,738	555	146	2,921
Total Projected Direct Cost Savings	\$5,417,719	\$20,535,523	\$6,292,385	\$1,737,604	\$33,983,231
Total Cost	\$3,872,439	\$14,000,113	\$4,474,166	\$1,186,107	\$23,532,825
Average Program Cost Effectiveness	1.40	1.47	1.41	1.46	1.44

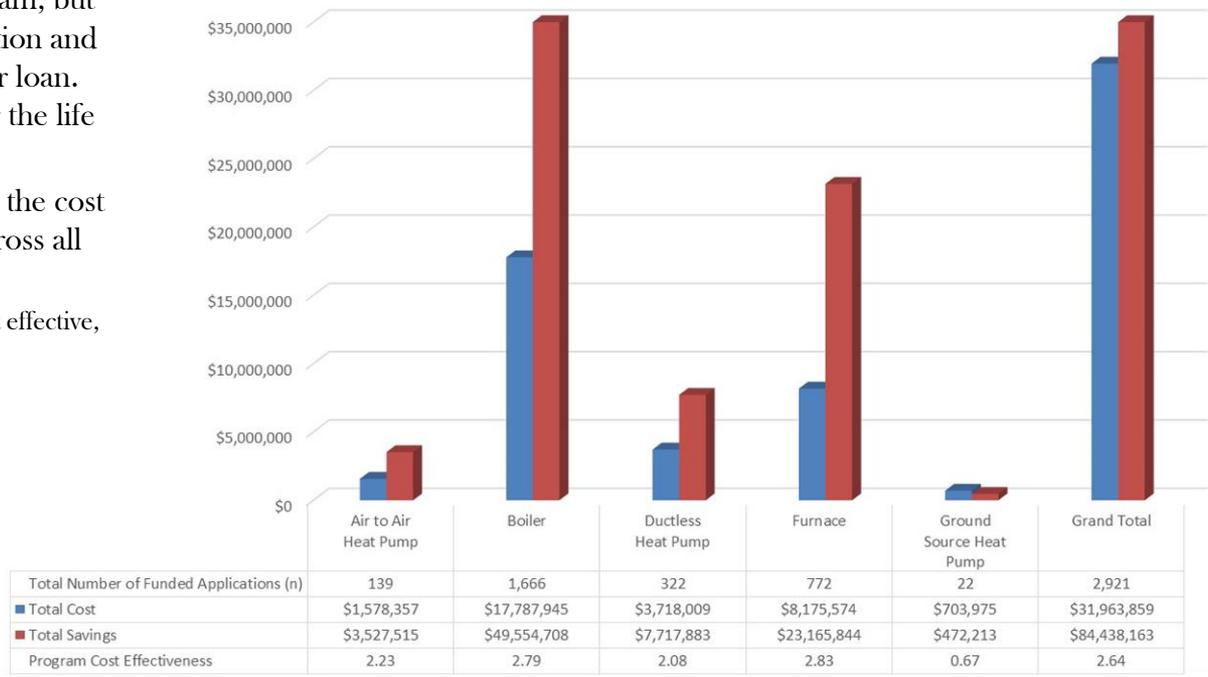
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COST EFFECTIVENESS OF PROGRAM* - BY IMPROVEMENT TYPE (TOTAL PROGRAM COST PERSPECTIVE)

- This total program benefit cost ratio differs from the participant cost effectiveness analysis in that the cost portion of the ratio is not only the total amount financed by the program, but adds in the upfront customer contribution and the \$1,100 that it costs the program per loan. The benefits side includes savings over the life of the measure (vs. life of the loan)
- From a total program cost perspective, the cost effectiveness ratio calculates to 2.64 across all improvement types.
 - Furnaces and boilers are the most cost effective, at 2.83 and 2.79 respectively.

Cost Effectiveness by Improvement Type - Total Program Cost Perspective



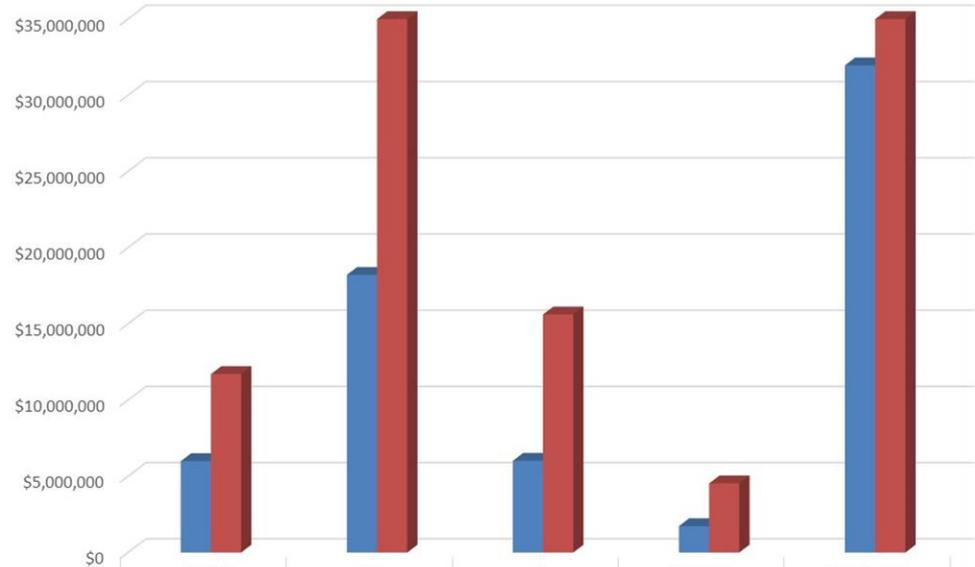
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COST EFFECTIVENESS OF PROGRAM* - BY FUEL TYPE (TOTAL PROGRAM COST PERSPECTIVE)

- This total program benefit cost ratio differs from the participant cost effectiveness analysis in that the cost portion of the ratio is not only the total amount financed by the program, but adds in the upfront customer contribution and the \$1,100 that it costs the program per loan. The benefits side includes savings over the life of the measure (vs. life of the loan)
- From a total program cost perspective, the cost effectiveness ratio calculates to 2.64 across all fuel types.
 - Gas-fuel funded projects are the most cost effective at 2.89, with propane next at 2.62.

Cost Effectiveness by Fuel Type - Total Program Cost Perspective



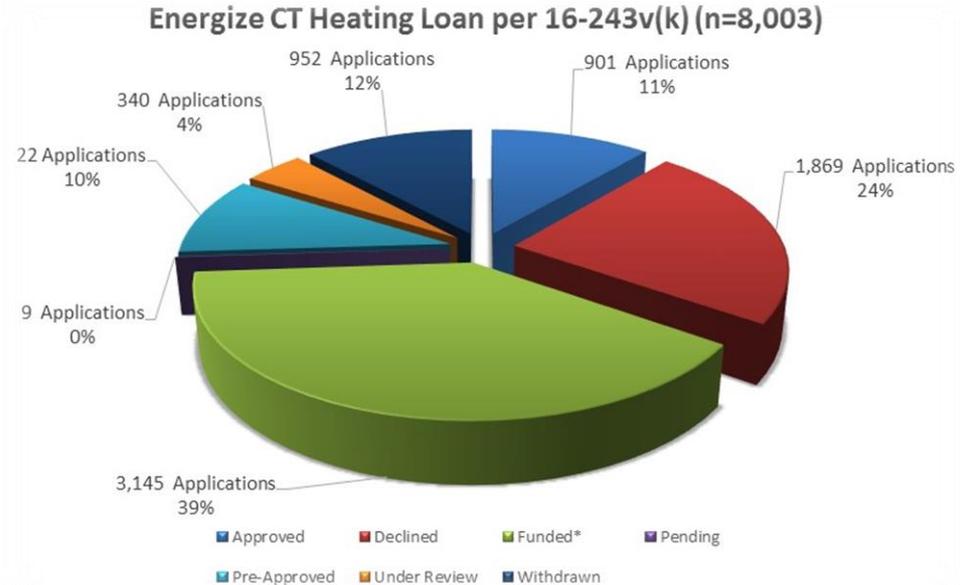
	Electric	Gas	Oil	Propane	Grand Total
Total Number of Funded Applications (n)	482	1,738	555	146	2,921
Total Cost	\$5,993,985	\$18,216,583	\$6,019,378	\$1,733,913	\$31,963,859
Total Savings	\$11,708,934	\$52,572,996	\$15,617,516	\$4,538,717	\$84,438,163
Program Cost Effectiveness	1.95	2.89	2.59	2.62	2.64

* These benefit-cost results are presented for informational purposes only and should not be used to assess overall program success or failure. Additional research is needed to determine appropriate baseline conditions and/or quantify the impact of customer incentives that were received outside of this program.



NUMBER OF CUSTOMERS

- ❑ The chart to the right shows the breakdown of all loan applications received between January 1, 2014 and November 17, 2015 and their associated status.
- ❑ Of the 8,003 total applications, 39% have already been funded (3,145 in total - including 2,921 having complete data available for analyses conducted in this study).
- ❑ Another 21% have been either approved or pre-approved, and 4% were still under review as of November 17, 2015.
- ❑ The remaining 36% of applications have been declined or withdrawn.
- ❑ See Appendix C for detailed tables associated with this study's Number of Customers analyses.

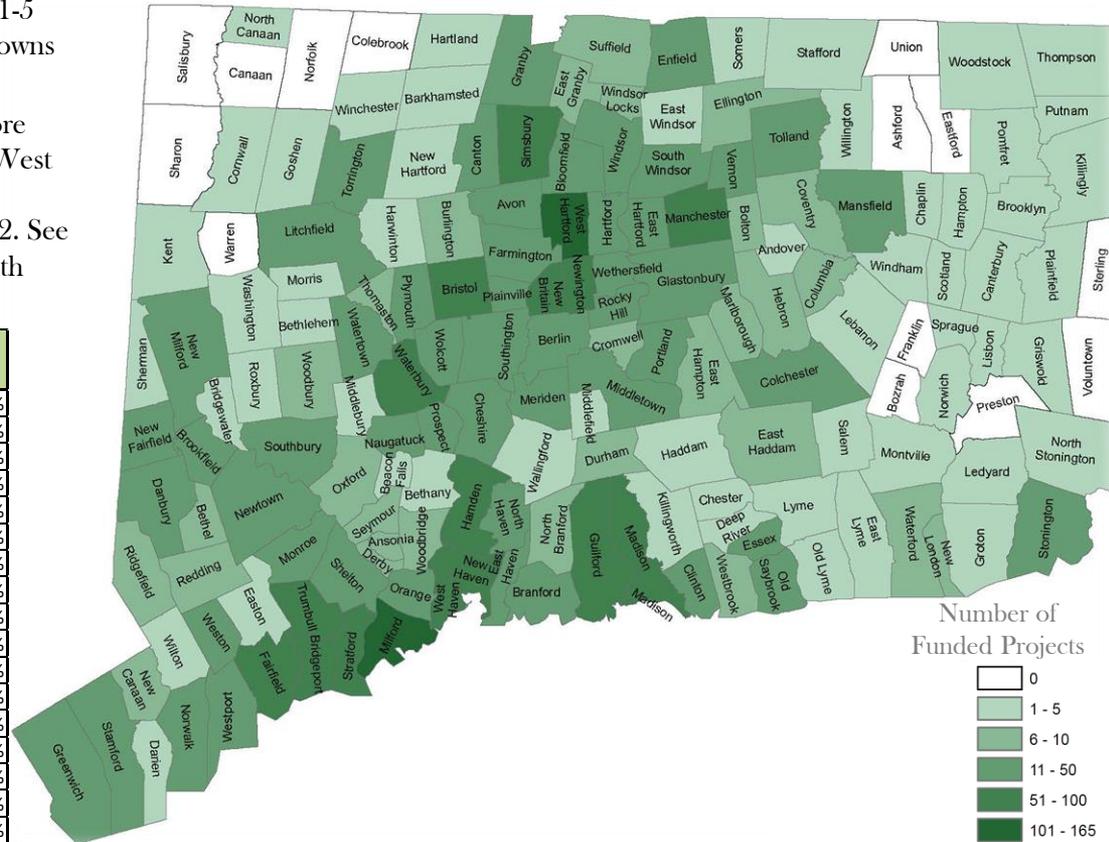


NUMBER OF CUSTOMERS – GEOGRAPHIC DISTRIBUTION

- 155 towns in the clean data set have at least one funded project, including 57 towns with only 1-5 funded projects, 29 towns with 6-10, and 52 towns having 11-50 funded projects.
- As seen in the table below, 17 towns have more than 50 funded projects. Of these 17 towns, West Hartford has the most projects with 165 and Milford has the second most projects with 112. See Appendix C for tables containing all towns with funded projects.

Number of Funded Projects by Town (n=2,921)

Town	# of Funded Projects	% of Funded Projects
West Hartford	165	5.65%
Milford	112	3.83%
Hamden	95	3.25%
New Haven	94	3.22%
Fairfield	92	3.15%
Bridgeport	85	2.91%
Stratford	85	2.91%
West Haven	69	2.36%
Manchester	66	2.26%
Bristol	62	2.12%
Trumbull	62	2.12%
Waterbury	62	2.12%
Madison	60	2.05%
Guilford	57	1.95%
Newington	57	1.95%
New Britain	51	1.75%
Simsbury	51	1.75%



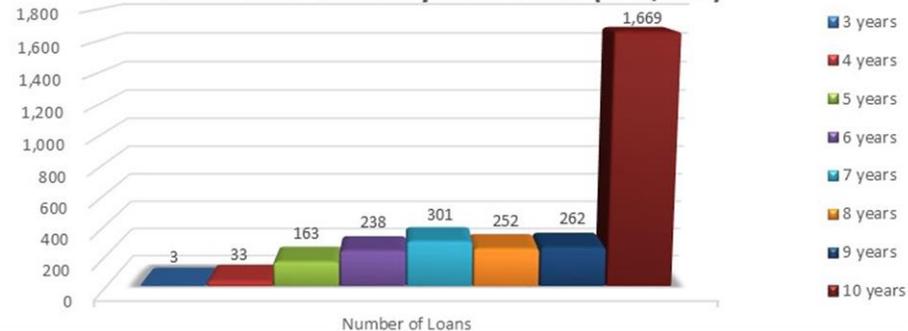
NUMBER OF CUSTOMERS – BY INTEREST RATE AND LOAN TERM

- ❑ The interest rate for loans offered through this program first began at 2.99%. The rate was reduced to 0.00% starting in October, 2014 but was returned to 2.99% effective November 1, 2015.
- ❑ The top chart on the right shows a breakdown of funded projects with 0.00% loan rates and 2.99% loan rates. The majority (91%) of loans are at 0.00% and 9% are at a rate of 2.99%.
- ❑ The bottom chart on the right shows a distribution of funded projects by loan term length. The majority of loans have a term length of 10 years (57%), with 36% of funded projects having loan terms of 6 to 9 years.

Funded Loans by Interest Rate (n=2,921)



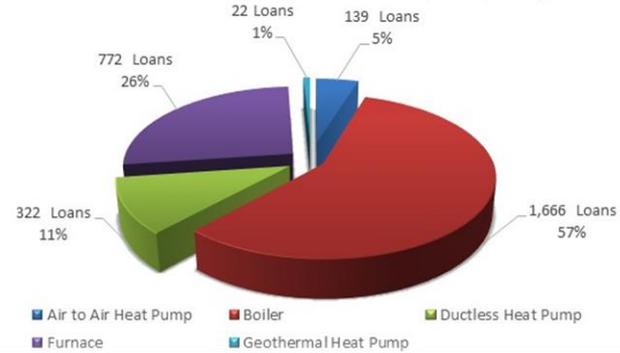
Number of Loans by Loan Term (n=2,921)



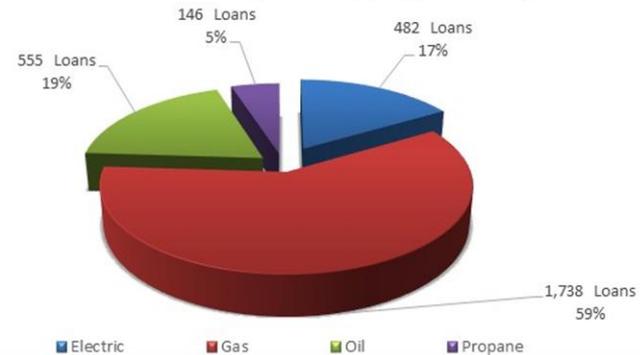
NUMBER OF CUSTOMERS – BY IMPROVEMENT TYPE AND FUEL TYPE

- As seen to the right in the top pie chart of funded projects by improvement type, a majority of improvements (57%) are boiler upgrades, with the next most common upgrade being furnace replacements (26%).
- The bottom chart shows a majority of the funded projects use gas as their fuel (59%). Oil and electric come next with 19% and 17% respectively, with funded projects fueled by propane having the lowest percentage (5%).

Funded Loans by Measure (n=2,921)



Funded Loans by Fuel Type (n=2,921)



POTENTIAL FOR PROGRAM GROWTH *

As shown in the scenarios to the right, of the total 1,394,888 combined Eversource and United Illuminating residential electric customers, an estimated remaining potential for additional participation in the Residential Furnace & Boiler Loan Program could range from between 13,500 to 28,000 over the next five years (1.0% to 2.5% of eligible residential household population) – this equates to 2,700 and 5,600 systems per year.

LIKELY OBTAINABLE POTENTIAL - SCENARIO 1	
Total Eversource Residential Customers	1,111,467
Total UI Residential Customers	283,421
Total Combined Eversource/UI Residential Customers	1,394,888
Estimated # of Owner-Occupied Households	1,255,399
Total in Data Set	8,003
Funded	3,145
Approved/Pre-Approved	1,688
Pending/Under Review	349
Declined/Withdrawn	2,821
Remaining Non-Participating Residential Customers	1,250,217
Achievable Potential based on Units > 10 Years Old	422,371
Achievable Potential of units > 10 years old that customers state they plan to replace within the next 5 years	173,917
Estimated percent of units > 10 years old that will be replaced within the next 5 years <u>outside of the loan program</u>	84%
Remaining Likely Achievable Potential for Residential Furnace & Boiler Loan Program	28,018
Remaining Likely Achievable Potential for Residential Furnace & Boiler Loan Program - as a percent of total CT residential households	2.5%

LIKELY OBTAINABLE POTENTIAL - SCENARIO 2	
Total Eversource Residential Customers	1,111,467
Total UI Residential Customers	283,421
Total Combined Eversource/UI Residential Customers	1,394,888
Percent of eligible customers	81.6%
Eligible population	1,138,461
Estimated System Replacements per Year (natural replacements)	36,725
Number of participants per month	225
Participants per year	2,698
Likely Obtainable Potential (n)	173,917
Mature program participation	2,698
Percent replaced outside of the loan program	92.65%
5 year potential	13,489
Percent of all residential households	1.0%

It is important to note that actual future participation will be greatly impacted by the price of fuel and the interest rate of loans at time of approval.

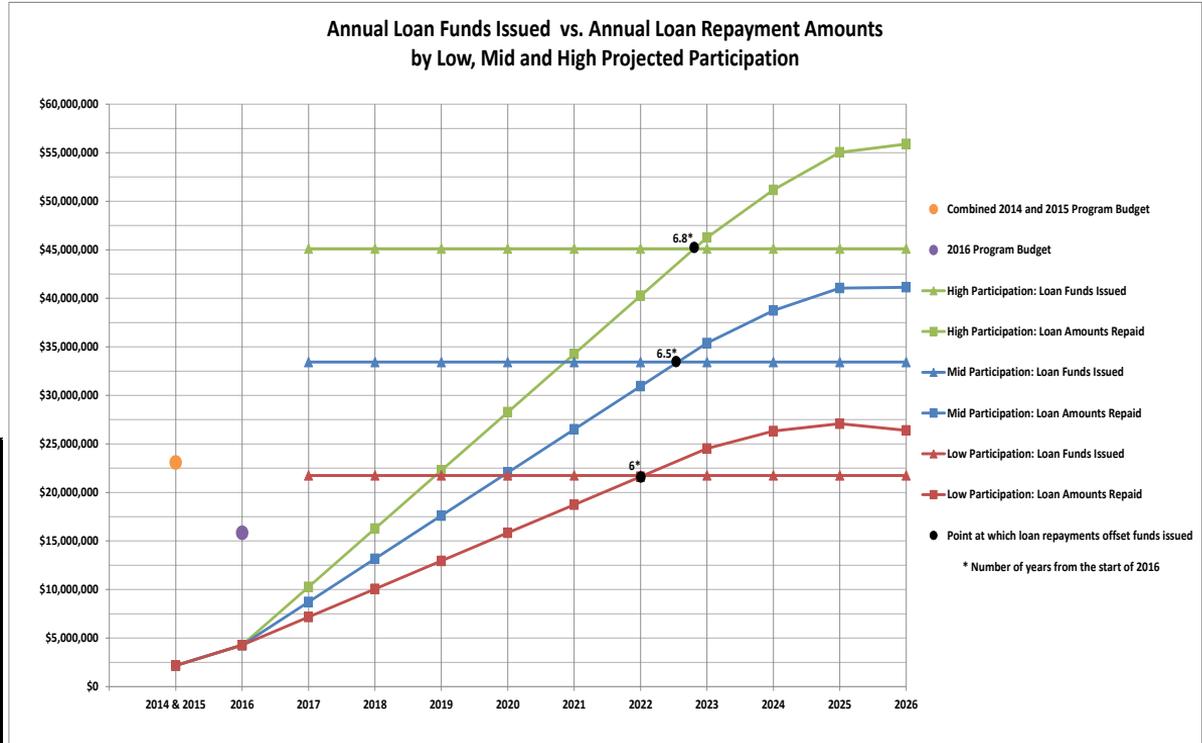


* Appendix D-1 provides more details regarding the assumptions going into these scenarios



POTENTIAL FOR PROGRAM GROWTH – ELECTRIC RATEPAYER IMPACT

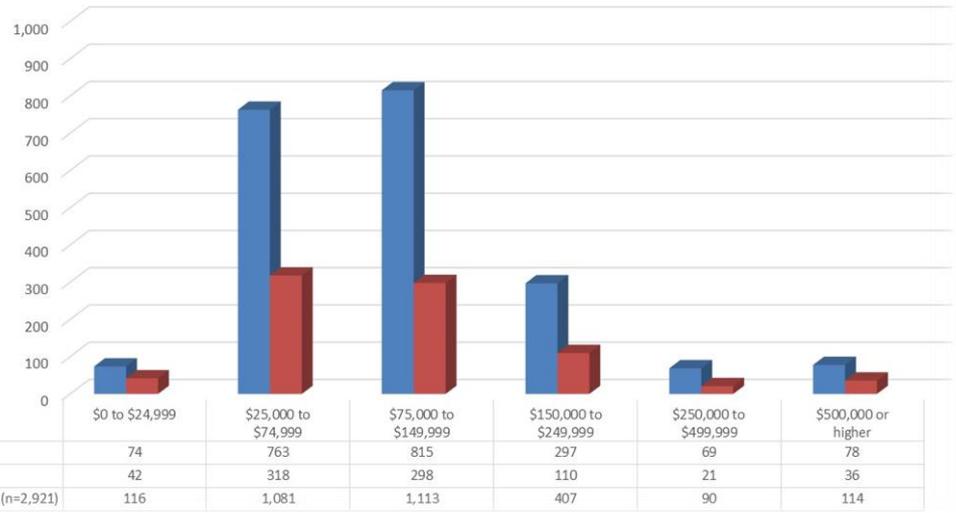
- From the program potential for growth analysis on the previous page, the number of annual loans was projected for low, mid, and high participation (see Analysis Inputs table below).
- Using the analysis inputs from the table below, the loan funds issued and the loan amounts repaid to the program were charted for the three scenarios of low, mid, and high projected participation over the next ten years.
- In the chart on the right, it can be seen that the annual contributions from electric ratepayers (loan funds issued) will be fully offset through annual loan repayment amounts between the years 2022 and 2023 for all three of the scenario projections (less than 7 years from a start of 2016).



CUSTOMER CLASSES SERVED

- Note: All income values are from customer self-reports and could over- or under-state actual household incomes.
- As shown in the chart to the right, a majority of the residential customers served through this program fall within two annual household income ranges: \$25,000 to \$74,999 (37% of customers served) and \$75,000 to \$149,999 (38%).
- The table below shows the number and percentage of residential customers who fall at or below the 60% and 80% median income level, broken down by utility.
- From this table it can be seen that 21% of customers served through the program are at or below 60% of the state median income level (35% are at or below 80%).
- See Appendix E for detailed tables of the Customer Classes Served analysis.

Overall Customer Classes Served



60% State Median Income	Utility		Grand Total (n)	Percentage Breakdown			80% State Median Income	Utility		Grand Total (n)	Percentage Breakdown		
	Eversource	United Illuminating		Eversource	United Illuminating	Combined		Eversource	United Illuminating		Eversource	United Illuminating	Combined
At or Below	410	208	618	20%	25%	21%	At or Below	689	323	1,012	33%	39%	35%
Above	1,686	617	2,303	80%	75%	79%	Above	1,407	502	1,909	67%	61%	65%
Grand Total (n)	2,096	825	2,921	100%	100%	100%	Grand Total (n)	2,096	825	2,921	100%	100%	100%



CUSTOMER CLASSES SERVED – BY IMPROVEMENT TYPE

- As shown in the chart on the right, within all of the income ranges served, boilers are consistently the most common improvement type followed by furnaces.
- The tables below provide detailed breakdowns of participation rates among households at or below [or above] 60% and 80% of State Median income levels. As seen in these tables, furnaces and boilers are the most commonly funded projects at a combined 47% and 74% of the 60% and 80% of state median income levels respectively.
- The percent of participants at or below (or above) the 60% and 80% of state median income levels are noted in the columns, broken out by company.

Customer Classes Served by Improvement Type



60% State Median Income	Percent of Projects Funded - by Improvement Type														
	Air to Air Heat Pump			Boiler			Ductless Heat Pump			Furnace			Ground Source Heat Pump		
	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined
At or Below	11%	11%	11%	20%	26%	22%	13%	21%	14%	25%	25%	25%	0%	0%	0%
Above	89%	89%	89%	80%	74%	78%	87%	79%	86%	75%	75%	75%	100%	100%	100%
Grand Total (n=2,921)	130	9	139	1,178	488	1,666	294	28	322	473	299	772	21	1	22

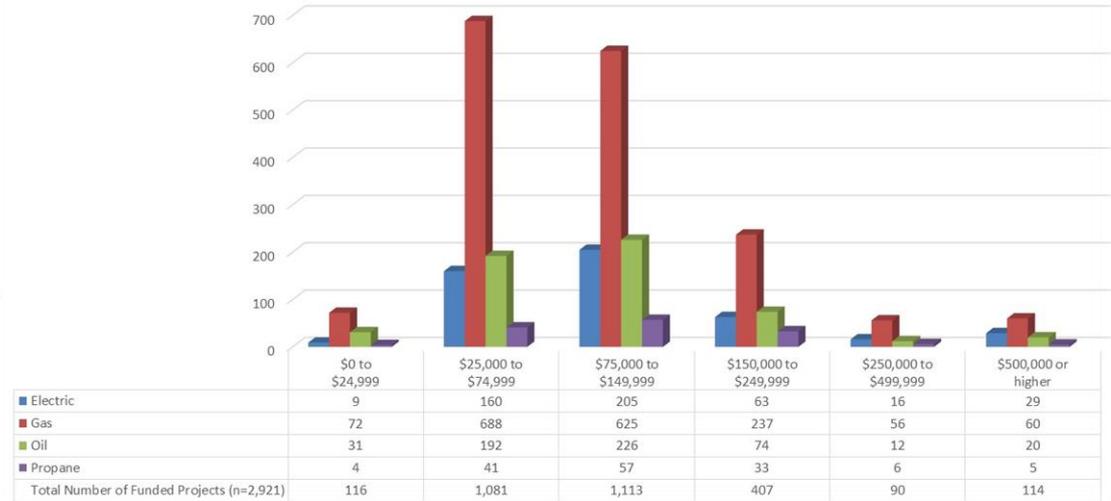
80% State Median Income	Percent of Projects Funded - by Improvement Type														
	Air to Air Heat Pump			Boiler			Ductless Heat Pump			Furnace			Ground Source Heat Pump		
	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined
At or Below	28%	11%	27%	34%	39%	36%	24%	36%	25%	37%	40%	38%	10%	0%	9%
Above	72%	89%	73%	66%	61%	64%	76%	64%	75%	63%	60%	62%	90%	100%	91%
Grand Total (n=2,921)	130	9	139	1,178	488	1,666	294	28	322	473	299	772	21	1	22



CUSTOMER CLASSES SERVED – BY FUEL TYPE

- As shown on the chart to the right, within all of the income ranges served, gas is consistently the most common fuel.
- For customers with household incomes ranging from \$0 to \$249,999, oil is the second most common fuel. Among customers with annual household incomes at or above \$250,000 the second most common fuel type is electric.
- The tables below provide a more detailed breakdown of project fuel types funded for customers at or below 60% and 80% of State Median income levels.

Customer Classes Served by Fuel Type



60% State Median Income	Percent of Projects Funded - by Fuel Type											
	Electric			Gas			Oil			Propane		
	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined
At or Below	12%	18%	12%	23%	25%	24%	21%	26%	21%	13%	29%	15%
Above	88%	82%	88%	77%	75%	76%	79%	74%	79%	87%	71%	85%
Grand Total (n=2,921)	444	38	482	1,044	694	1,738	483	72	555	125	21	146

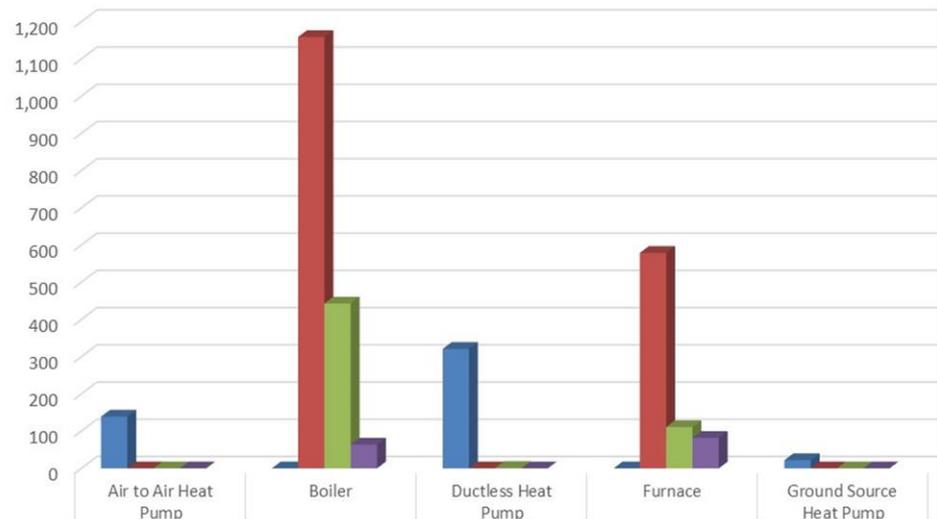
80% State Median Income	Percent of Projects Funded - by Fuel Type											
	Electric			Gas			Oil			Propane		
	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined
At or Below	25%	29%	25%	37%	39%	38%	35%	42%	36%	23%	38%	25%
Above	75%	71%	75%	63%	61%	62%	65%	58%	64%	77%	62%	75%
Grand Total (n=2,921)	444	38	482	1,044	694	1,738	483	72	555	125	21	146



FUEL TYPE OF FINANCED EQUIPMENT

- As shown in this chart, boilers and furnaces funded through this program are most commonly fueled by gas. The air-to-air, ductless and ground source heat pumps all are most commonly fueled by electricity.
- When funded furnace and boiler replacements require switching from one fuel to another, most of such fuel switches are with new boilers changing from oil to gas. The next most common is a switch from oil to electric heat pump for new air-to-air, ductless or ground source heat pump systems.
- See Appendix F for detailed tables of the Fuel Type of Financed Equipment analysis.

Improvement Type Installed by Fuel Type



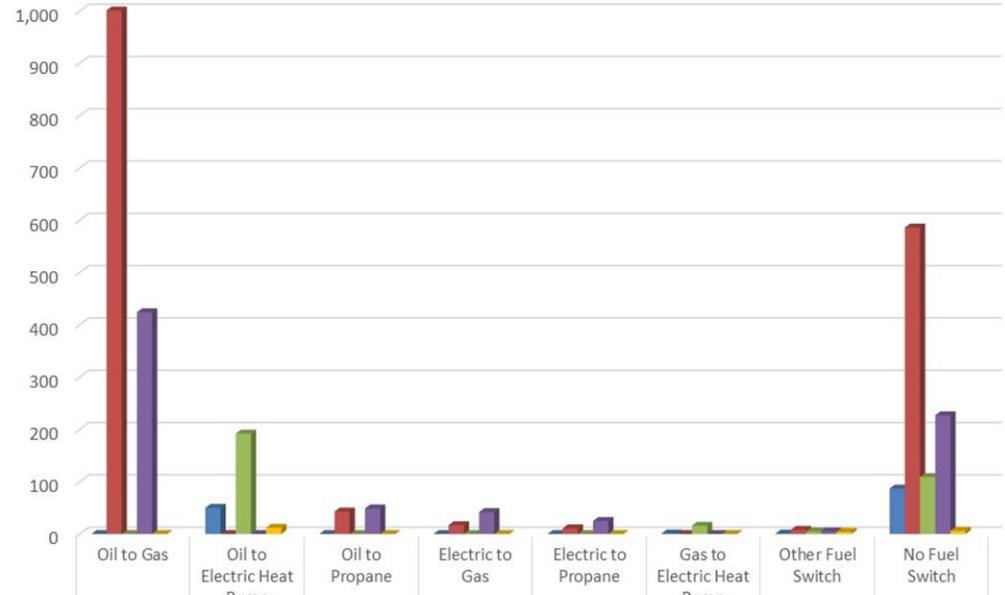
■ Electric	139	0	321	0	22
■ Gas	0	1,159	0	579	0
■ Oil	0	443	1	111	0
■ Propane	0	64	0	82	0
Total Number of Funded Projects (n=2,921)	139	1,666	322	772	22



FUEL TYPE OF FINANCED EQUIPMENT - FUEL SWITCH

- When funded furnace and boiler replacements require switching from one fuel to another, most of such fuel switches are with new boilers changing from oil to gas.
- The next most common is a switch from oil to electric heat pump for new air-to-air, ductless or ground source heat pump systems.

Improvement Type Installed by Fuel Switch



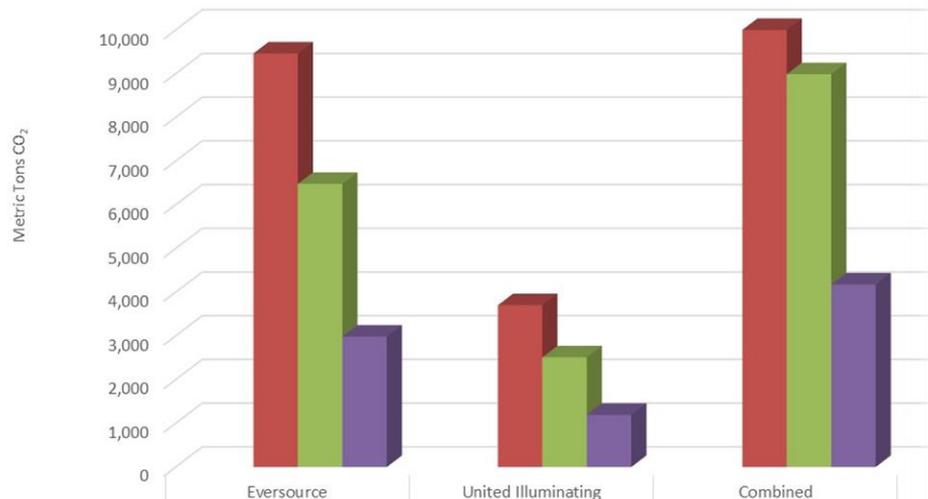
Air to Air Heat Pump	0	50	0	0	0	1	1	87
Boiler	1,001	0	43	17	11	0	8	586
Ductless Heat Pump	0	192	0	0	0	16	5	109
Furnace	424	0	49	42	25	0	5	227
Ground Source Heat Pump	0	12	0	0	0	0	4	6
Total Number of Funded Projects (n=2,921)	1,425	254	92	59	36	17	23	1,015



CO₂ EMISSIONS*

- The CO₂ estimates are calculated from the MMBtu savings per customer converted to metric tons of CO₂ using a conversion factor specific to the fuel type.
- The chart to the right shows the projected annual metric tons of CO₂ emitted without the improvement, after the improvement, and the difference of the two representing the total annual savings. Results are also broken down by utility.
- As can be seen from this chart, the metric tons CO₂ saved per utility is proportional to the number of funded applications (n) for each utility.
- See Appendix G for detailed tables of the CO₂ Emissions analysis.

Annual CO₂ Emissions by Utility



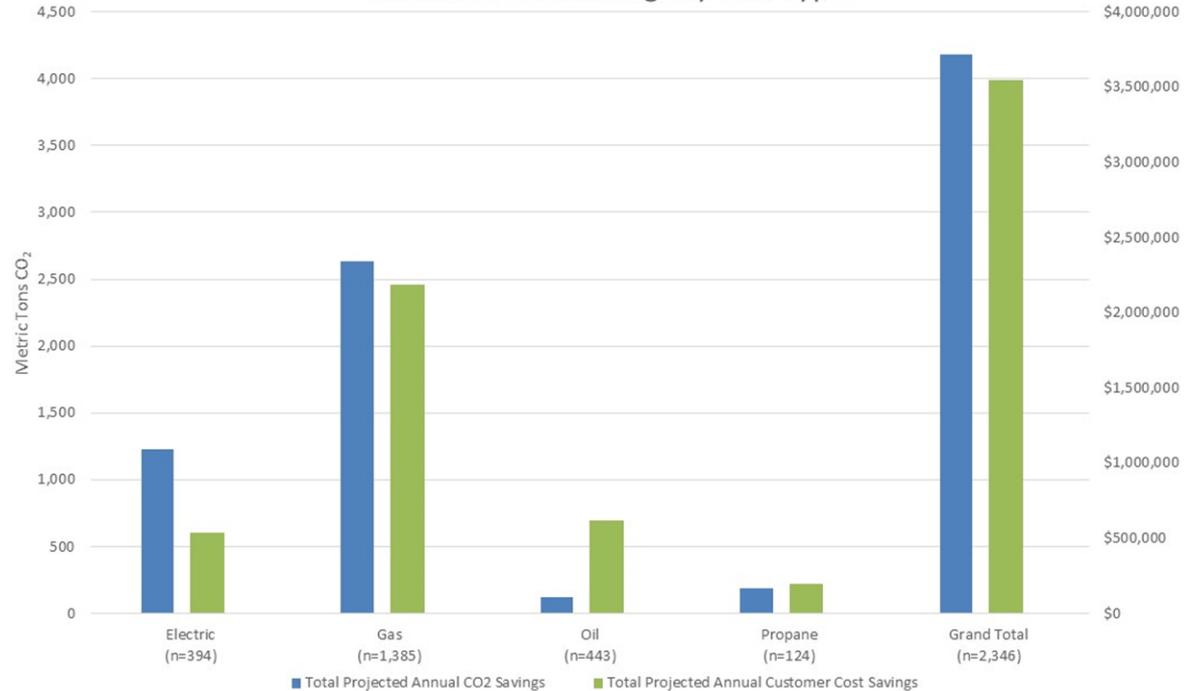
Total Number of Funded Applications with CO ₂ Data Available (n)	1,699	647	2,346
Total Projected Annual CO ₂ Emitted without Improvement (Metric Tons)	9,462	3,703	13,165
Total Projected Annual CO ₂ Emitted after Improvement (Metric Tons)	6,478	2,510	8,988
Total Projected Annual CO ₂ Savings (Metric Tons)	2,984	1,193	4,177



CO₂ EMISSIONS* - BY FUEL TYPE

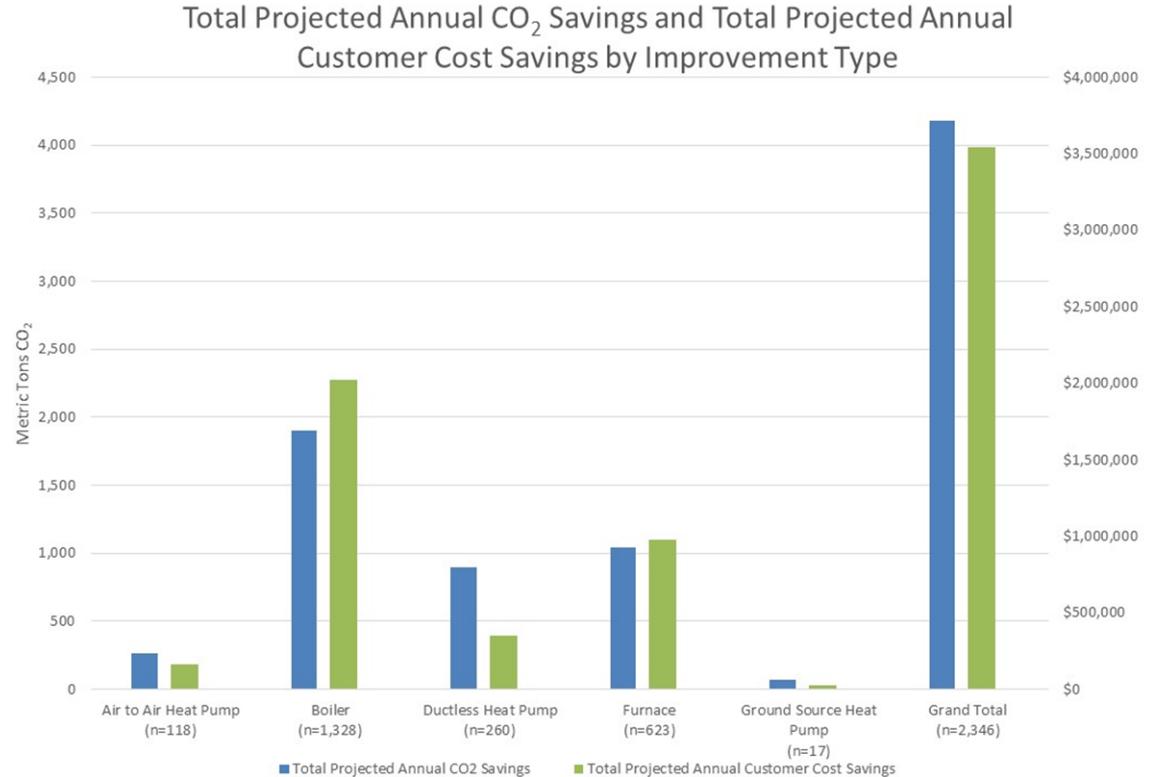
- The chart to the right shows the annual projected CO₂ savings compared to the annual projected customer cost savings, broken down by fuel type.
- As seen in this chart, a majority of annual CO₂ and cost savings comes from the large number of funded improvements that are fueled by gas.
- The lesser number of improvements, where the base and new equipment remained fueled by oil, have resulted in the least amount annual CO₂ savings (when viewed across the total number of program-funded improvements), while having the second highest annual projected customer cost savings.
- See Appendix G for detailed tables of the CO₂ Emissions analysis.

Total Projected Annual CO₂ Savings and Total Projected Annual Customer Cost Savings by Fuel Type



CO₂ EMISSIONS* - BY IMPROVEMENT TYPE

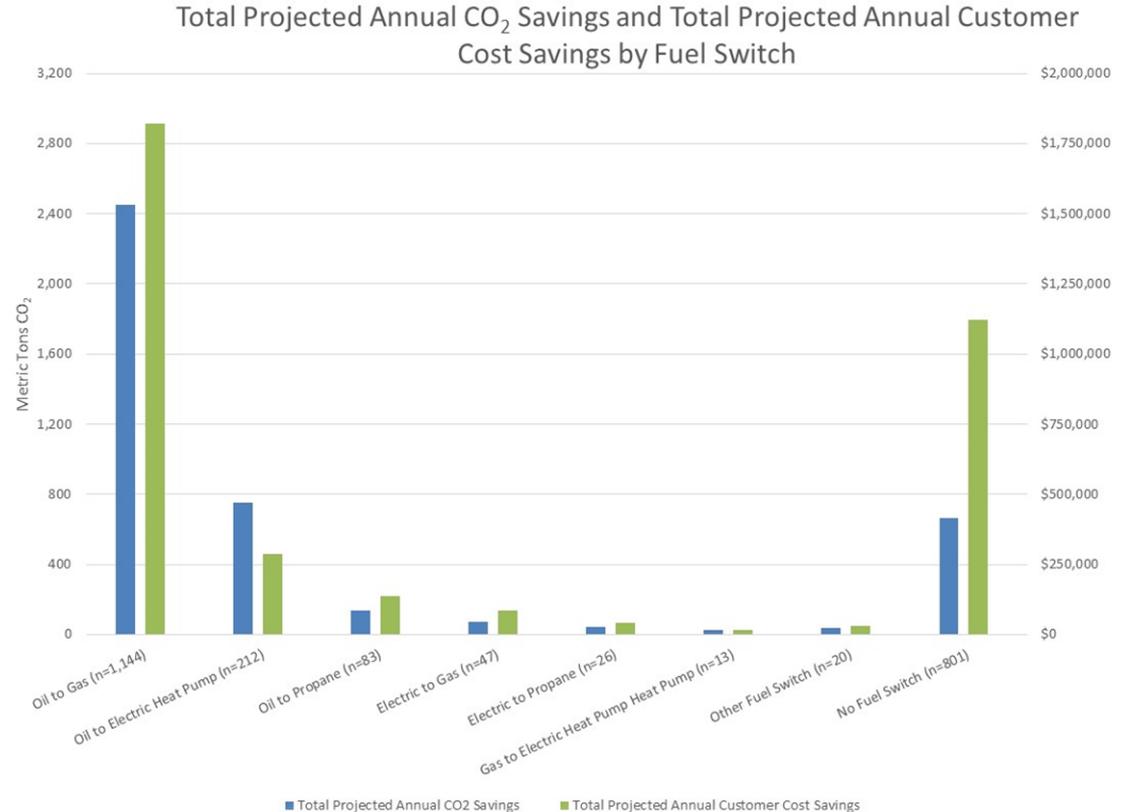
- ❑ The chart to the right shows the annual projected CO₂ savings compared and annual projected customer cost savings, broken down by improvement type.
- ❑ Boiler improvements show the greatest annual CO₂ and projected customer cost savings, followed by furnace replacement projects and ductless heat pumps.
- ❑ Savings from ground source heat pumps are relatively minimal due to the small number (n=17) of systems installed through the program during this study period.
- ❑ See Appendix G for detailed tables of the CO₂ Emissions analysis.



*CO₂ Emissions were calculated using the ISO-NE Marginal Emissions report.

CO₂ EMISSIONS* - BY FUEL SWITCH

- The chart to the right shows the annual projected CO₂ savings and projected customer cost savings, broken down by fuel switch type.
- As seen in this chart, the large number of funded improvements that ultimately were fueled by gas (1,144 projects) have resulted in the greatest total amount of annual CO₂ reductions and customer cost savings, followed by electricity-fueled improvements (mainly driven by oil-to-gas and oil-to-electric heat pump conversions).
- See Appendix G for detailed tables of the CO₂ Emissions analysis.



*CO₂ Emissions were calculated using the ISO-NE Marginal Emissions report.

RESIDENTIAL CLEAN ENERGY ON-BILL REPAYMENT PROGRAM

The Connecticut Green Bank On-Bill Repayment (OBR) Program, first authorized in June of 2013, focuses on providing financing options for customers looking to install energy efficient equipment, as well as supporting the household conversion to more efficient fuels. OBR allows residential utility customers to repay loans for qualifying energy efficiency and clean energy improvements through a line item charge on their monthly utility bill.

There are no results to summarize in this report regarding the Connecticut Green Bank's OBR program, as formal implementation is not anticipated until Quarter 1 of 2016. Following is a time-line overview of the OBR development process:

Time-Line of Connecticut Green Bank On-Bill Repayment Program Development

- ❑ June 2013 - State of Connecticut General Assembly authorized On-Bill Repayment (OBR) - Section 58 of Public Act 13-298 (Section 60a-40m)
- ❑ Over many subsequent months, the Companies and Green Bank began working to develop a written document regarding the OBR process and how it would work on each side.
 - OBR process requires IT changes and how the costs would be handled.
- ❑ April 2014 - Connecticut Energy Efficiency Board voted against using utility shut-off provision for non-payment.
- ❑ May 23, 2014 - Connecticut Green Bank and Connecticut Energy Efficiency Board submitted a joint application to the Public Utilities Regulatory Authority (PURA) for review and approval of the On-Bill Repayment Program (Docket 14-05-40).
- ❑ July 2014 - Amended Application submitted by Connecticut Green Bank and Connecticut Energy Efficiency Board.
- ❑ August 18, 2014 - PURA draft decision issued.
- ❑ August 22, 2014 - CL&P, UI, OCC and Green Bank written exceptions filed.
- ❑ August 27, 2014 - PURA Final Decision issued.
- ❑ April 2015 - Agreement between CL&P and UI and the Green Bank was signed.
- ❑ July 2015 - MOU between the Servicing Agent and Eversource was signed.
- ❑ October 2015 - MOU between Servicing Agent and UI was signed with ability to begin exchanging files in November 2015.
- ❑ Green Bank quarterly update to the Residential Committee of the Connecticut Energy Efficiency Board indicates they have begun speaking to lenders regarding OBR and expect to kick process off in Quarter 1 of 2016.



APPENDICES

Appendix A - Data Set Development

Appendix B - Cost Effectiveness of Program

Appendix C - Number of Customers

Appendix D - Potential for Program Growth

Appendix E - Customer Classes Served

Appendix F - Fuel Type of Financed Equipment

Appendix G - CO₂ Emissions

